Jacobsville Neighborhood Soil Contamination Site

Evansville, Indiana
Vanderburgh County

Record of Decision

United States Environmental Protection Agency

Region 5

September 2009

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/dL	Micrograms per deciliter
ARAR	Applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	Below ground surface
BLL	Blood lead level
BTAG	Biological Technical Assistance Group
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CIP	Community Involvement Plan
COC	Chemical of concern
COPC	Chemical of potential concern
COPEC	Chemical of potential ecological concern
CSM	Conceptual Site Model
CTE	Central tendency exposure
DCL	Default closure level
DQO	Data quality objectives
ELCR	Excess lifetime cancer risk
EPC	Exposure point concentration
EPW	Evansville Plating Works
ERA	Ecological risk assessment
ESD	Explanation of Significant Difference
FS	Feasibility study
GPS	Global Positioning System
HHRA	Human health risk assessment
HI	Hazard index
HQ	Hazard quotient
HRS	Hazard Ranking System
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IEUBK	Integrated Exposure Uptake Biokinetic Model
IWQS	Indiana Water Quality Standards
JNSC	Jacobsville Neighborhood Soil Contamination Site
LOAEL	Lowest observed adverse effect level
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
NCP	National Contingency Plan
NOAEL	No observed adverse effect level
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable unit
OU1	Operable Unit 1

OU2	Operable Unit 2
ppm	Parts per million
PRG	Preliminary remediation goal
PRP	Potentially Responsible Party
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial action objective
RBSL	Risk based screening level
RCRA	Resource Conservation and Recovery Act
RfD	Reference dose
RI	Remedial investigation
RI/FS	Remedial investigation/feasibility study
RME	Reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	Slope factor
SPLP	Synthetic precipitation leaching procedure
TAL	Target analyte list
TBC	To be considered
TBD	To-be-determined
TCLP	Toxicity characteristic leaching procedure
TRV	Toxicity reference value
U.S. EPA	United States Environmental Protection Agency
U.S. FWS	United States Fish and Wildlife Service
UCL	Upper confidence limit
UTL	Upper tolerance limit
XRF	x-ray fluorescence

This Record of Decision (ROD) documents the remedy selected Operable Unit 2 for the Jacobsville Neighborhood Soil Contamination site in Evansville, Vanderburgh County, Indiana. This is the final ROD for the site. The ROD is organized in two sections: Part I contains the *Declaration* for the ROD and Part II contains the *Decision Summary*. The *Responsiveness Summary* is included as Appendix A.

PART I: DECLARATION

This section summarizes the information presented in the ROD and includes the authorizing signature of the United States Environmental Protection Agency (U.S. EPA) Region 5 Superfund Division Director.

Site Name and Location

The Jacobsville Neighborhood Soil Contamination site (CERCLIS # INN000508142) is a residential lead site located in Evansville, Vanderburgh County, Indiana. The site is divided into two operable units. The first operable unit (OU1) is roughly bounded by the Lloyd Expressway (State Highway 62) to the south, Mary Street to the west, Iowa Street to the north, and Elliot Street to the east. Operable unit 1 encompasses 141 acres including approximately 500 residential properties in the Jacobsville neighborhood of Evansville (See Figure 1). OU1 was addressed in a ROD signed in February 2008. The second operable unit (OU2) extends outward from OU1 and covers approximately 4.5 square miles. Of the approximate 10,000 residences in OU2, it is anticipated that approximately 4,000 residences will require cleanup. This ROD addresses the selected cleanup for OU2.

Statement of Basis and Purpose

This decision document presents the selected remedy for the Jacobsville Neighborhood Soil Contamination site OU2. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). Information used to select the remedy is contained in the Administrative Record file for the site. The Administrative Record file is available for review at the U.S. EPA Region 5 Records Center, 77 West Jackson Boulevard, Chicago, Illinois, and at the Evansville Vanderburgh Public Library – Central Branch, 200 S.E. Martin Luther King Jr. Boulevard, Evansville, Indiana.

Assessment of the Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

Description of the Selected Remedy

The Jacobsville Neighborhood Soil Contamination site is being addressed as two operable units under the framework set forth in CERCLA. The selected remedy specified in this ROD addresses OU2 and serves as the final action for the site. The selected remedy specifies response actions through removal of contaminated soil, backfill with clean soil, and restoration of the site. The OU2 remedy is the same type of remedy as selected for OU1. U.S. EPA believes the response actions outlined in this ROD will protect human health and the environment.

The selected remedy for OU2 consists of excavating soil from residential properties that have concentrations in the soil that exceed the site-specific clean up levels for lead and/or arsenic. The depth of excavation will be determined at each residential property by determining the depth of contamination at each property and also physical barriers limiting soil excavation. The cleanup levels for both OU1 and OU2 are 400 parts per million (ppm) for lead and 30 ppm for arsenic. Although the majority of the exceedences of lead and arsenic cleanup levels have been one foot in depth, soils will be excavated down to a maximum of eighteen inches, if necessary. Clean soils will be backfilled into the property and the property will be restored to as near the original condition as possible. Because it is not likely that it will be possible to obtain access to all affected properties, it is possible that contamination above cleanup levels will remain on the site. Therefore, it is likely that five-year reviews will be required after the site is remediated. Institutional controls will be needed at properties which are contaminated but for which access is not obtained and for properties which may have contamination above cleanup levels after excavation to 18 inches. A type of institutional control that is anticipated is a lead hazard registry that lists the remediation status of all properties. There are no principal threat wastes at the site. Since no viable responsible parties have been identified to date, U.S. EPA, in partnership with the Indiana Department of Environmental Management (IDEM), expect to be responsible for implementing the remedy.

The major components of the selected remedy are:

- Residential yards containing lead and/or arsenic at concentrations greater than the cleanup levels will have the soils excavated to the depth that the elevated concentrations are found, up to 18 inches. If physical barriers exist, such as large trees, soil will be excavated around the barrier to the extent possible. Engineering controls will be implemented in order to prevent exposure to lead and arsenic from dust created by the excavation of the soils. Building foundations, permanent walkways and fixtures will not be affected by the soil excavation.

- Once excavation is complete, clean fill will be placed in the excavated areas, and the lawns will be returned to as close to their original condition as possible.

- Excavated soils will be transported to a RCRA Subtitle D landfill. This remedy assumes that the excavated soil will not be characterized as hazardous waste. This was confirmed by toxicity characteristic leaching procedure (TCLP) analyses performed on soils during the remedial design for OU1, where the more highly contaminated soils are expected. If possible, soil will be put to reuse, such as at industrial sites or as daily cover at a landfill.

- Whenever possible, cleanup priority will be given to those residents at higher risk, such as homes with children under 7 years of age. In addition, U.S. EPA will work with residents with special needs to ensure the cleanup can proceed without adversely affecting them.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to this remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies (or resource recovery) to the maximum extent practicable. This remedy does not satisfy the preference for treatment as a principal element of the remedy for the following reasons: (1) the in situ treatment technology that exists for arsenic and lead in soils has not been studied enough to prove its long-term effectiveness and permanence, (2) in situ treatment technologies are less cost-effective than this remedy, (3) the chosen remedy is a permanent remedy which physically removes all soils having concentrations greater than the cleanup levels and is widely accepted by the community, and (4) no source materials consisting of principal threat wastes will be addressed within the scope of this action; therefore, treatment of wastes prior to disposal was not evaluated. Because this remedy may result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews will probably be required for this remedial action. Five-year reviews will be required if properties are identified as requiring cleanup but U.S. EPA is unable to gain access to the properties in order to implement the remedy.

Data Certification Checklist

The following information is included in the Decision Summary section (Part II) of this ROD. Additional information can be found in the Administrative Record file for this site.

- Contaminants of concern and their respective concentrations (Section 5);
- Baseline risk represented by the contaminants of concern (Section 7);
- Cleanup levels established for contaminants of concern and the basis for these levels (Section 8);
- How source materials are not considered a principal threat (Section 11);
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD (Sections 6 and 7);
- Potential land use that will be possible at the site as a result of the selected remedy (Section 12);
- Estimated total present worth costs and the number of years over which the remedy cost estimates are projected (Sections 9 and 12); and
- Key factors that led to selecting the remedy (Sections 10 and 12).

Support Agency Acceptance

The State of Indiana concurs with the selection of Alternative 2 for OU2 of the Jacobsville Neighborhood Soil Contamination site. The State of Indiana's concurrence letter is provided in Appendix B.

Authorizing Signature

Richard C. Karl, Director
Superfund Division
United States Environmental Protection Agency, Region 5

9-22-09
Date

PART II: DECISION SUMMARY

1.0 Site Name, Location, and Brief Description

The Jacobsville Neighborhood Soil Contamination site is located in Evansville, Vanderburgh County, Indiana. The site consists of residential soils contaminated by lead and arsenic. The site was named the Jacobsville Neighborhood Soil Contamination site because the contamination was initially found in the Jacobsville neighborhood of Evansville; however, after further investigations, U.S. EPA found that contamination extended to other areas of Evansville. The site is divided into two operable units. The first operable unit (OU1) is roughly bounded by the Lloyd Expressway (State Highway 62) to the south, Mary Street to the west, Iowa Street to the north, and Elliot Street to the east, and was addressed in the ROD published in February 2008. OU1 encompasses 141 acres of residential properties in the Jacobsville neighborhood of Evansville and is shown in Figure 1. The second operable unit (OU2) extends outward from OU1 and covers approximately 4.5 square miles (see Figure 2). A section in the middle part of OU2, labeled "to be determined (TBD)" in the figure, is currently undergoing additional sampling to determine whether it will be included as part of OU2. This ROD addresses the remediation of OU2, which will be final action at the site. U.S. EPA, in agreement with the Indiana Department of Environmental Management (IDEM), believes the remedy is necessary to protect human health and the environment due to actual and potential exposure to lead and arsenic in residential soils. U.S. EPA is the lead agency for this site, and IDEM is the support agency. The U.S. EPA CERCLIS number is INN000508142. Site remediation is expected to be financed by U.S. EPA with a 10 percent share financed by the State of Indiana.

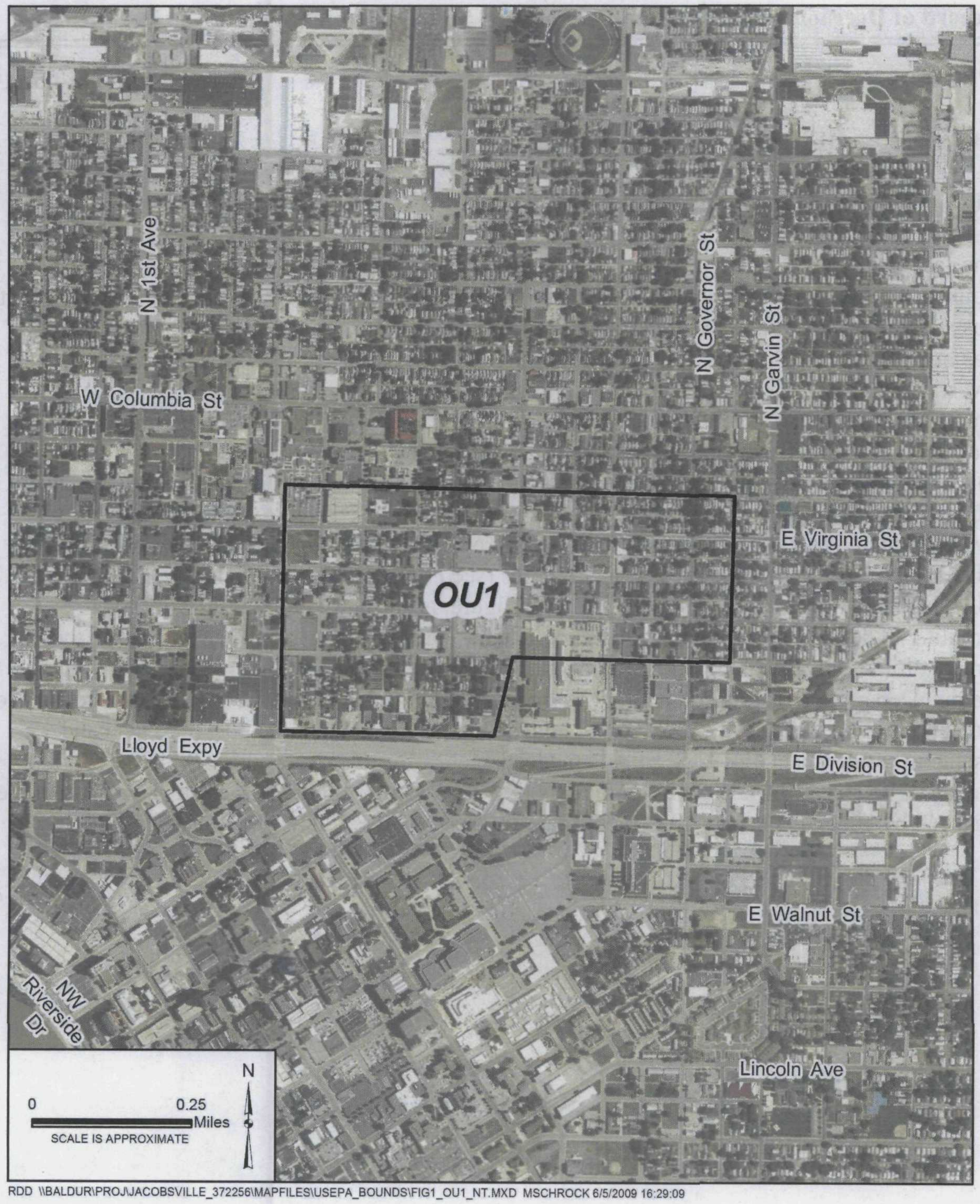

Figure 1. Map of OU1 of Jacobsville Neighborhood Soil Contamination Site

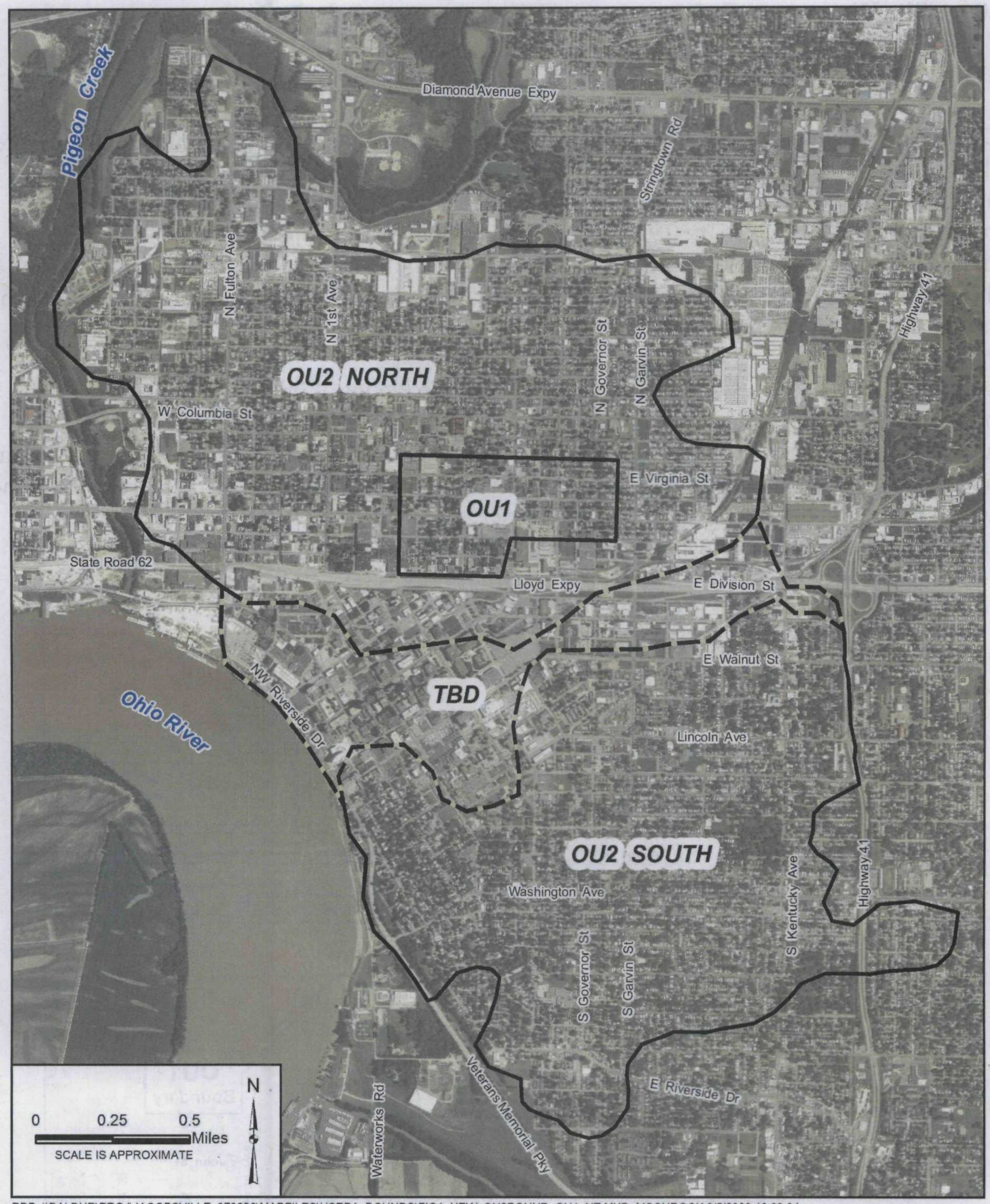

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Figure 2. Map of OU1 and OU2 of Jacobsville Neighborhood Soil Contamination Site

2.0 Site History and Enforcement Activities

2.1 Source of Contamination

IDEM identified four former facilities that may have contributed to the contamination at the site: Blount Plow Works (operated from the 1880s to about the 1940s), Advance Stove Works (operated from approximately the 1900s to the 1950s), Newton-Kelsay (operated from approximately the 1900s to the 1950s), and Sharpes Shot Works (operated from 1878 to an unknown date) (Figure 3). The facilities were located within or near the boundaries of OU1. There were at least five other foundries in the area that also may have contributed to the lead and arsenic contamination in the soil.

In addition to the facilities referenced above, Evansville Plating Works (EPW) may have also contributed to the contamination. The company, which began operations in 1897, plated parts using zinc, brass, nickel, copper, iron black (iron oxide), cadmium, and chromium for individuals and industry. Evansville Plating Works was located at 100 West Indiana Street, just south of the Jacobsville neighborhood (Figure 3). The one-acre site was formerly occupied by a large, dilapidated, one-story building. The building was demolished, and the lot is now empty.

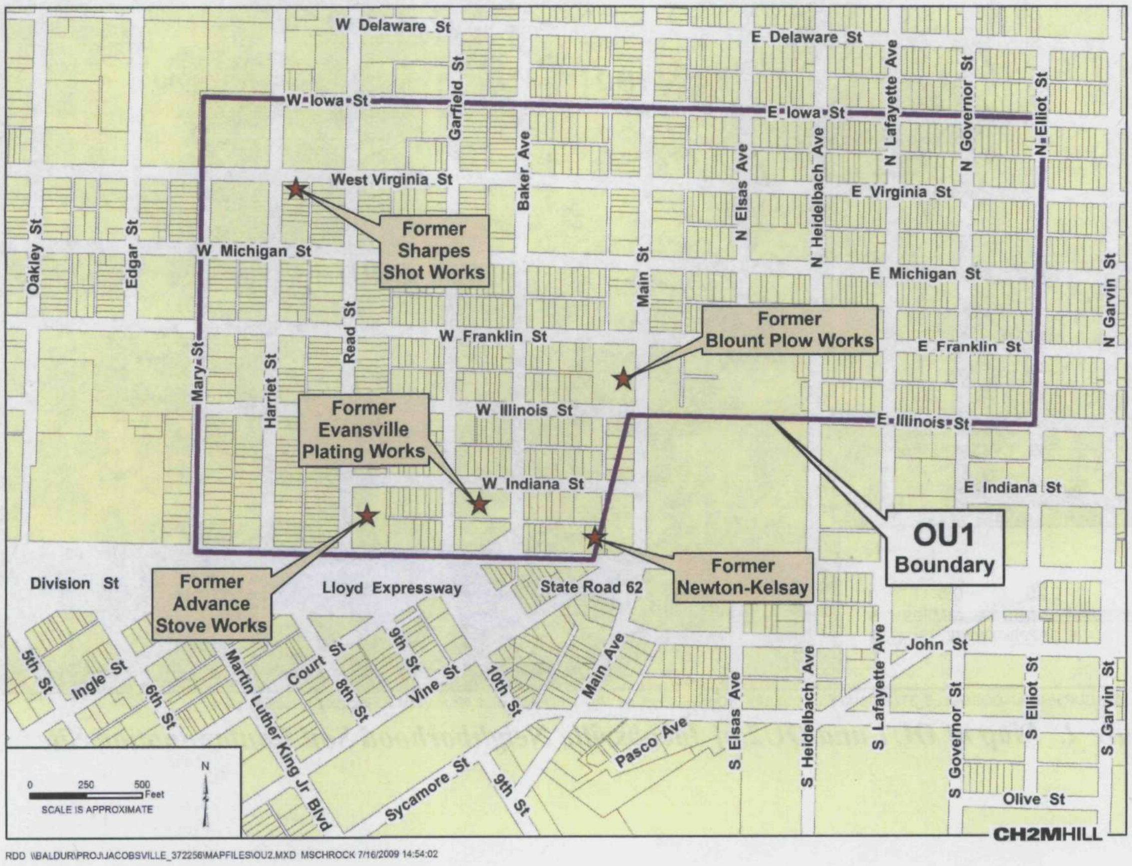

Figure 3. Boundary of OU1 and Locations of Former Facilities

2.2 Previous Investigations

2.2.1 1990—Evansville Plating Works Site Investigation

In June 1990, U.S. EPA inspected Evansville Plating Works, sampled various spills and precipitates throughout the facility, and conducted air monitoring. Uncovered plating vats, drums, and precipitates were observed on the outside of the drums. Based on the site inspection and analytical results, U.S. EPA recommended a removal action. Following the removal action, U.S. EPA assigned a "No Further Remedial Action Planned" status to the Evansville Plating Works site.

2.2.2 2002—Integrated Assessment Report for JNSC Site

In the summer and fall of 2000, IDEM conducted a reassessment of the Evansville Plating Works site because off-site samples were not collected as part of the site screening inspection. The reassessment included residential soil sampling. Analysis of the soil samples collected in 2000 revealed elevated levels of lead in residential soils near the Evansville Plating Works property. The area investigated includes empty lots, city parks, commercial properties, an elementary school, and a hospital.

In June 2001, IDEM collected 189 soil samples around the Jacobsville neighborhood and analyzed them for lead using portable x-ray fluorescence (XRF) to complete the Hazard Ranking System (HRS) scoring report. Samples were collected from a depth of 0 to 6 inches. Fifty-seven samples were sent to a laboratory for analysis. IDEM determined that the migration pathways included groundwater, surface water, soil, and air, but the soil exposure pathway was the only pathway of concern.

Lead concentrations exceeding U.S. EPA action levels were detected in most of the residential soils. Two samples were collected as background samples. Lead concentrations in these background samples were determined to be 86 ppm. The highest lead concentration observed in soil was 7,700 ppm.

A storm drain system controls surface runoff from the site and conveys the collected storm water to the Evansville Wastewater Treatment Plant. The treated water is discharged to the Ohio River. No air samples were collected. IDEM stated that there was no potential risk to nearby residents by the air pathway, provided that contaminated sediments or soils did not become airborne.

2.2.3 2002—Hazard Ranking System

The Hazard Ranking System (HRS) is the principal mechanism U.S. EPA uses to place uncontrolled waste sites on the National Priorities List. The HRS for the Jacobsville Neighborhood Soil Contamination site integrated information from the previous investigations to determine a score of the site's relative potential as a risk to human health and the environment.

Four release pathways are assessed as part of the HRS: groundwater migration, surface water migration, soil exposure, and airborne migration. The risk factor categories evaluated were likelihood of release into the environment, waste characteristics, and targets affected by a release. U.S. EPA has established an HRS cutoff score of 28.50 for listing on the National Priorities List. Sites that achieve a score of 28.50 or higher are eligible for listing.

IDEM staff completed the HRS documentation in September 2002 for the JNSC site. The site received a score of 71.04 for the soil exposure pathway. The other pathways were not evaluated. Overall, the JNSC site received a score of 35.52. On the basis of that score, IDEM recommended that the site be included on the National Priorities List.

2.2.4 2003—Site Assessment Report for Evansville Plating Works

In January 2003, U.S. EPA conducted a site assessment of Evansville Plating Works. XRF was used to screen 49 soil samples and also dust within the building. One sample outside the building contained mercury at a concentration of 780 ppm. At 13 locations, lead was detected at concentrations exceeding 2,000 ppm, and at six locations chromium exceeded 2,000 ppm. No contamination was discovered within subsurface samples from the 10 locations screened with XRF.

Seven investigative samples, including soil and building materials, were collected and analyzed for total metals. The seven samples contained concentrations exceeding selected criteria for arsenic, cadmium, and chromium. Contaminant concentrations in six of the samples exceeded the IDEM residential default closure levels (DCLs) for copper, lead, and nickel. Iron exceeded U.S. EPA Region 3's risk-based criterion and U.S. EPA Region 9's preliminary remediation goals (PRGs) for residential soils in five of the samples. Four samples exceeded the IDEM residential DCLs for selenium and zinc, and three exceeded the criterion for mercury. Antimony, barium, and thallium results exceeded the IDEM residential DCLs in two of the samples, and silver exceeded this criterion in one sample. Due to these exceedences, an additional removal action was performed at the site by U.S. EPA.

2.2.5 2004—Site Characterization 1

In November and December 2004, U.S. EPA performed soil sampling for the JNSC site using a portable XRF and laboratory verification samples based on a random grid sample design. The sampling plan was designed to determine the areal extent of contamination and spatial distribution of surficial contamination and extended beyond the IDEM defined site boundary. Forty-nine locations were sampled using two XRF units to screen soil for lead and other metals (see Figure 4). Of the samples collected, 20 percent were sent to the laboratory for metals analysis (beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, silver, sodium, vanadium, and zinc). The highest lead reading observed was outside the IDEM defined site boundary (which is approximately equal to the OU1 boundary), but was not located at a residential property. The second highest lead concentration was within the IDEM boundary. Laboratory results were used to "calibrate" the XRF results. U.S. EPA determined that the XRF results were biased low. Locations with elevated concentrations were somewhat sporadic because of air deposition and grading activities.

2.2.6 2005—Site Characterization 2

Additional soil sampling was conducted in April 2005 because the November and December 2004 sampling event was inconclusive in determining the areal extent of contamination within the soils. A second sampling design was created to extend the sampling grid beyond the

November and December 2004 sampling design. Two grids were created: one that surrounded the previous sampling event (inner grid) and one that extended beyond the inner grid that could be used as needed (outer grid) (see Figure 4). During sampling, if two samples in a row (outward from the JNSC site) had XRF readings that did not exceed 200 ppm, sampling was not continued in that direction. Fifty-six locations were sampled and analyzed using XRF. The lab analyzed 15 of the soil samples for metals (beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, silver, sodium, vanadium, and zinc). Samples with adjusted concentrations greater than 400 ppm were within the Evansville city limits. The locations where lead was observed at a concentration greater than 400 ppm were somewhat sporadic because of air deposition and grading activities, but were generally within a 2-mile radius of the site. U.S. EPA recommended additional sampling to determine a site specific screening value for lead.

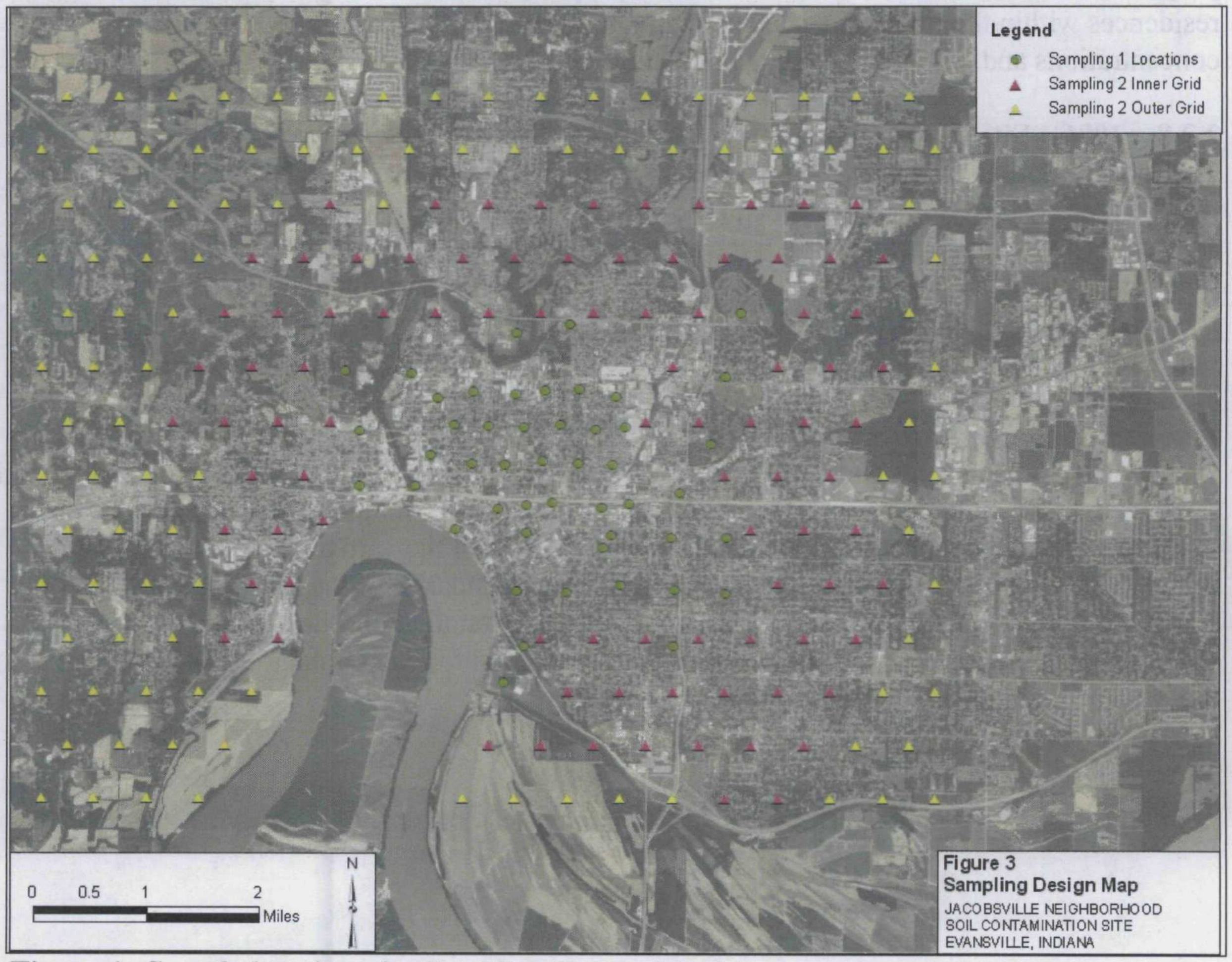

Figure 4. Sample locations for Sampling Events 1 and 2

2.2.7 2005—Site Characterization 3

The third sampling round by U.S. EPA was conducted on October 17 through 24, 2005. The sample network was designed to obtain data from areas where previous samples had high concentrations of lead. Specifically, the object was to characterize "hotspots" within the affected area. The sample locations were laid out on a grid.

One hundred forty-seven sample locations were analyzed using a portable XRF unit, and 29 soil samples were submitted to a laboratory for XRF data verification. Five-point composite soil samples were collected with samples taken at four corners of the yard and one taken in the center. A four-point composite drip zone sample (one sample from the midpoint of each side of the house) was collected at some of the residential sample locations to determine if lead paint may be contributing to the high levels of lead in soils. Sampling results that showed high lead concentrations confirmed previous results. Samples were also collected along boundaries determined during Site Characterization 2. Elevated (greater than 400 ppm) lead concentrations were not observed outside the boundaries. Samples with elevated lead concentrations were within the Evansville city limits and were within a 2 mile radius of the IDEM site boundary (which is approximately equal to the OU1 boundary). It was observed during this field investigation that many properties had been regraded, and that, in some cases, low concentration properties were adjacent to high concentration properties. Therefore, it is expected that some residences within the final delineated contamination area will not have elevated lead concentrations and will not need remedial action.

2.2.8 2006—Site Characterization 4

The fourth sampling round by U.S. EPA was conducted in October 2006. The sampling event was designed to determine if the size of the area of contamination could be refined and if the confidence interval about the expected number of properties at or above the Preliminary Remediation Goal (PRG) values for lead could be narrowed. An adaptive fill sampling design was created within the northern and southern areas of OU2. Adaptive fill sampling places new sampling locations in the least sampled areas, i.e., in areas farthest from other existing sampling locations.

One hundred seventy-one sample locations were analyzed using a portable XRF unit, and 35 soil samples were submitted to a laboratory for XRF data verification. Five-point composite soil samples were collected with samples taken at four corners of the yard and one taken in the center. The October 2006 sampling event verified the boundaries of the areal extent of lead contamination for the Jacobsville Neighborhood Soil Contamination Site, and the denser sampling design better described the lead contamination within the boundaries. Results from Site Characterizations 1 through 4 are shown in Figure 5.

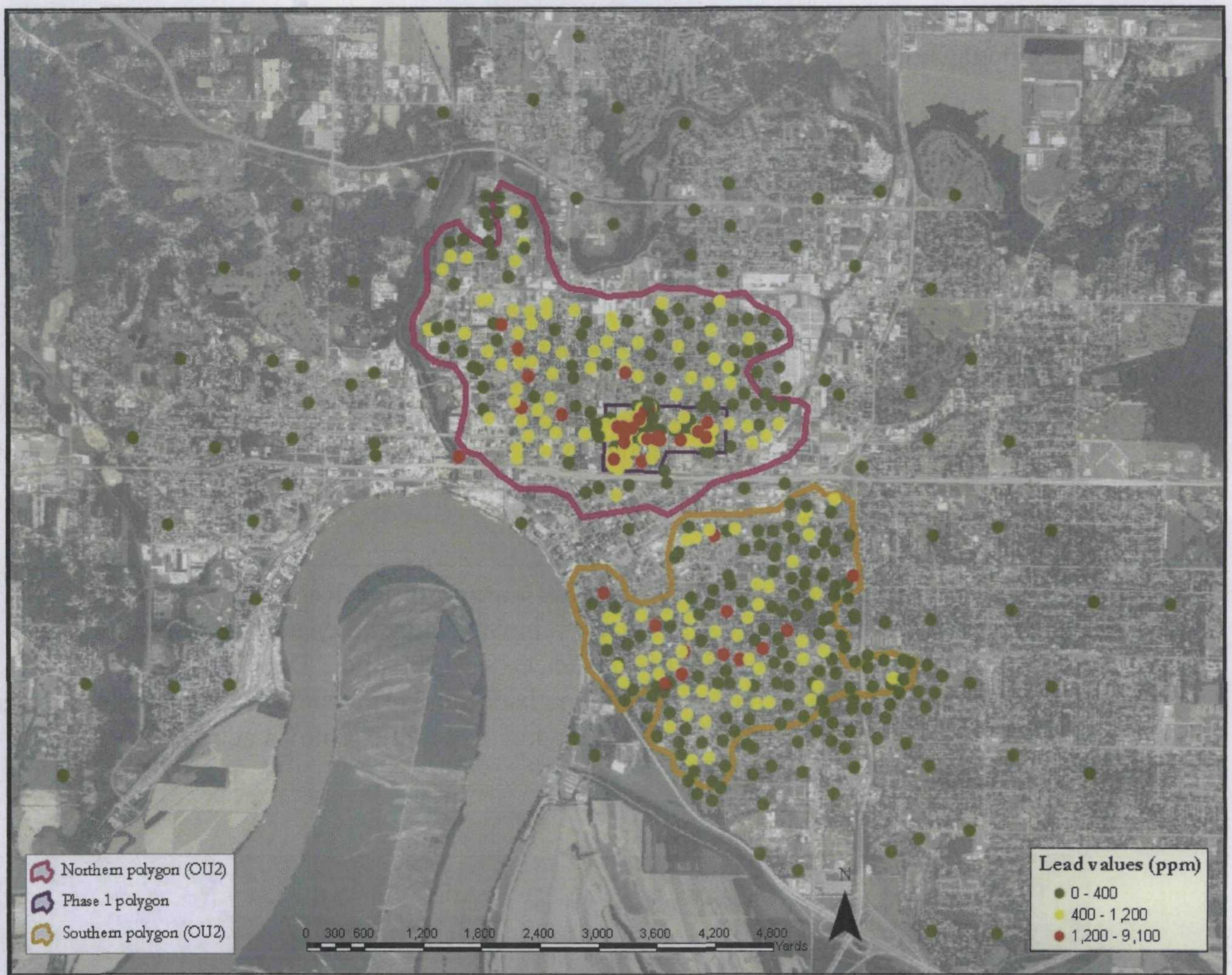

Figure 5. Results from U.S. EPA Site Characterizations 1 through 4

2.2.9 2006—Remedial Investigation/Risk Assessment Sampling

In 2006, groundwater, surface water, sediment and soil samples were collected by the U.S. EPA contractor, CH2M Hill, as part of the remedial investigation to acquire data to be used in human health and ecological risk assessments. Soil samples were also collected at depth intervals up to 18 inches. Background samples were collected for all media. Sampling determined that lead and arsenic were the contaminants of concern (COCs) for the site. To characterize site soil, 213 soil samples were collected from 103 properties from within the remedial investigation sampling boundaries to use in the risk assessments, and 12 samples were collected outside of these boundaries to serve as background locations.

2.2.10 2008—Remedial Design Sampling

Remedial design sampling for Phase I of OU1 was conducted in 2008 by CH2M Hill to determine the properties and portions of the properties that need remediation to address elevated concentrations of lead and arsenic in surface soil within OU1. Soil samples were collected from 124 properties and analyzed for lead and arsenic as part of Phase I of remedial design sampling. Soil samples were analyzed using an XRF instrument and "correlated" with samples sent to the laboratory for lead and arsenic analysis.

2.3 Previous Response Actions

2.3.1 U.S. EPA Evansville Plating Works Removal Action

U.S. EPA initiated a removal action at the Evansville Plating Works facility on July 2, 1990. During the removal action, liquid and solid waste streams were characterized and transported off site for treatment and/or disposal. About 18,245 gallons of hazardous liquid waste streams were transported off site for treatment and disposal and 22,391 cubic yards of hazardous debris was shipped off-site to a disposal facility. The removal action was completed on January 12, 1993. On-site sampling was done to verify that all hazardous materials had been removed. In July of 2000, IDEM took off-site samples to verify that the Evansville Plating Works facility had not contributed to contamination outside of the property. It was at this time that high levels of lead were found at the site and in nearby residential soils. A second removal action was conducted in September and October of 2003 that addressed the demolition of the building and removal of contamination and debris from the site.

2.3.2 U.S. EPA Jacobsville Neighborhood Soil Contamination Removal Action

On September 17, 2007, the U.S. EPA initiated a removal action at residential properties at the JNSC site where lead concentrations in the soils exceeded 1200 ppm. During the removal action, properties in areas where previous sampling had found lead levels of 1200 ppm or greater were sampled for lead. Eighty-three homes were addressed in the removal action, which was completed in early 2008 (see Figure 6).

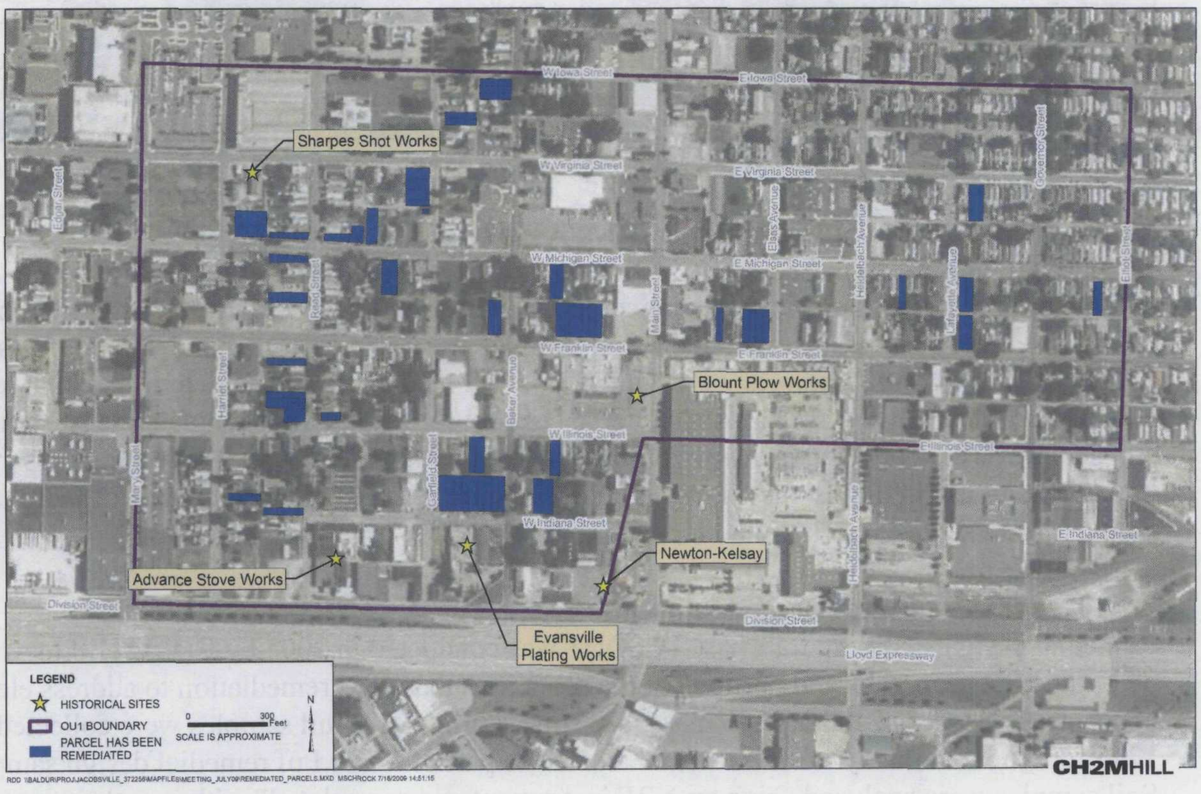

Figure 6. Properties Remediated during 2007/2008 Removal Action

2.4 Enforcement Activities

A search for Potentially Responsible Parties (PRPs) was conducted by U.S. EPA. To date, no viable PRPs have been identified; therefore no enforcement actions have been pursued.

3.0 Community Participation

The Proposed Plan for the Jacobsville Neighborhood Soil Contamination site OU2 was made available to the public for comment in June 2009. Copies of the Proposed Plan and the final Remedial Investigation (RI) and Feasibility Study (FS) reports (as well as other supporting documents) were placed in the local Information Repository located at the Evansville Vanderburgh Public Library—Central Branch—Public Comment Shelf. Documents are also available at the U.S. EPA Region 5 Records Center in Chicago, Illinois. Copies of the Proposed Plan as well as an announcement for the two public meetings to discuss the Proposed Plan were mailed to approximately 10,000 residents and other interested parties. Copies of all documents supporting the remedy outlined in the Proposed Plan are located in the Administrative Record file for the site, located at the U.S. EPA Region 5 Records Center, 77 West Jackson Boulevard, Chicago, Illinois, and the Vanderburgh Public Library—Central Branch in Evansville, Indiana. (See Appendix C for Administrative Record Index.)

The public comment period ran from June 11 through July 10, 2009. U.S. EPA held two public meetings and one press briefing to present the Proposed Plan. The press briefing was held on June 23, 2009, in the afternoon, at the Vanderburgh County Health Department. The first public meeting was on June 23, 2009, in the evening, and the second public meeting was on June 24, 2009, in the morning. Both public meetings took place at the Vanderburgh Public Library—Central Branch in Evansville, Indiana. About 80 people overall attended the meetings. The notice announcing the public meetings and the availability of the Proposed Plan was published in the Evansville Courier Press on June 4, 2009, to alert media and the public about issuance of the Proposed Plan and the deadline for the public comment period.

Representatives of U.S. EPA and IDEM were at the public meetings to present the Proposed Plan and answer questions regarding the proposed remedy. Representatives from the City of Evansville, Vanderburgh County Health Department, Agency for Toxic Substances and Disease Registry (ATSDR), the Jacobsville Area Community Corporation, and the United Neighborhoods of Evansville were also present at the meetings. Responses to comments received during the public comment period (including comments received at the public meetings) are included in the Responsiveness Summary which is Appendix A of this ROD. These comments were considered prior to selection of the final remedy for the Jacobsville Neighborhood Soil Contamination site. U.S EPA developed a Community Involvement Plan (CIP) when RI/FS activities began at the site in 2004. The CIP, Proposed Plan, and news releases were also posted to the U.S. EPA Region 5 website at: www.epa.gov/region5/sites/jacobsville.

4.0 Scope and Role of Response Action and Operable Units

The U.S. EPA has organized the work to be performed at the Jacobsville Neighborhood Soil Contamination site into two operable units (OUs):

Operable Unit 1: The first operable unit, which was the subject of the 2008 ROD, consists of contaminated residential soils within the boundaries of Lloyd Expressway (State Highway 62) to the south, Mary Street to the west, Iowa Street to the north, and Elliot Street to the east (see Figures 1 and 2). OU1 encompasses 141 acres and 508 residential properties. It is estimated that about 350 of the homes within OU1 will require cleanup. The greatest percentages of exceedences of lead and arsenic cleanup levels were found in soils in OU1. This area also contained all four facilities that are likely responsible for the soil contamination (see Figure 3). OU1 will be the first operable unit addressed at the site, and remediation activities at OU1 will be financed by U.S. EPA, with a 10 percent share financed by the State of Indiana.

Operable Unit 2: The second operable unit consists of contaminated residential soils outside the boundaries of OU1 and encompasses approximately 4.5 square miles within the city boundaries of Evansville, Indiana. The general boundaries for OU2 are Pigeon Creek to the west, Diamond Avenue Expressway to the north, U.S. Highway 41 to the east, and Veterans Memorial Highway to the south (see Figure 2). The soils in this area were found to have levels of lead and arsenic above the cleanup levels and are likely to have contamination to a lesser depth than found in OU1. There are approximately 10,000 homes within OU2 and it is estimated that approximately 4,000 of the homes will require cleanup. This ROD for OU2 represents the final response action for the site. Remediation activities at OU2 will be financed by U.S. EPA, with a 10 percent share financed by the State of Indiana.

U.S. EPA addressed the site in its entirety in the RI report dated September 2006. Two separate FS reports were prepared for OU1 and OU2. The site was divided into two operable units so that the soils with the highest levels of lead and arsenic found in OU1 could be addressed first.

5.0 Site Characteristics

5.1 Conceptual Site Model for Jacobsville Neighborhood Soil Contamination Site

The conceptual site model (CSM) provides an understanding of the site based on the sources of contaminants of concern, potential transport pathways, and environmental receptors. Based on the nature and extent of contamination and the fate and transport mechanisms described in the RI and FS reports, the refined CSM includes the following components:

- For the site-wide human health and ecological risk assessments, all possible exposure routes, including recreational activities outside of the site boundaries, were considered. There are no excess risks associated with contaminants in the groundwater, surface water, and sediments at the site.

- Site-wide, arsenic and lead in surface soils were identified as chemicals of concern for human health exposures. Ingestion, dermal contact, and inhalation of the lead and arsenic from soils are complete exposure pathway to residents and industrial workers at the site.

- No chemicals of concern were identified for ecological receptors at the site.

5.2 Site Overview

The Jacobsville Neighborhood Soil Contamination site is located in Evansville, Indiana and encompasses approximately 4.5 square miles containing residential properties that have soils with concentrations above the cleanup levels of 400 ppm for lead and 30 ppm for arsenic. The general boundaries for OU2 site are Pigeon Creek to the west, Diamond Avenue Expressway to the north, U.S. Highway 41 to the east, and Veterans Memorial Highway to the south. OU1 is within OU2 and is bounded by the Lloyd Expressway (State Highway 62) to the south, Mary Street to the west, Iowa Street to the north, and Elliot Street to the east. OU1 contains the highest percentages of exceedences of lead and arsenic cleanup levels and is where the four former facilities thought to be responsible for the contamination are located. OU1 encompasses 141 acres and 508 residential properties. OU2 encompasses about 4.5 square miles and includes about 10,000 homes. It is expected that about 4,000 homes within OU2 will require cleanup. A section in the middle part of OU2, labeled "TBD" in Figure 2, is currently undergoing additional sampling to determine whether it will be included as part of OU2.

The areas of OU1 and OU2 are a mixture of residential, commercial, and industrial properties. Surficial soils contaminated with lead and arsenic present an exposure risk to children and adults at residential and recreational properties within the site boundaries. Sampling thus far has found lead and arsenic concentrations above cleanup levels at depths of two feet or less, although the results from the remedial design sampling for OU1 showed that 99 percent of the exceedences were in the top 18 inches or less. There are two surface water bodies near the site, Pigeon Creek, which is the westerly boundary of OU2, and the Ohio River, which is one quarter mile from the OU2 boundary. The site does not lie within a floodplain.

The site is located in the Ohio River basin. Unconsolidated sand and gravels, along with Pennsylvanian sandstones and limestones, make up the aquifers in the region. There are four main aquifers in Vanderburgh County: the Linton, Dugger, and Patoka formations, which are bedrock aquifers, and the Ohio River Valley aquifer, consisting of terrace and floodplain deposits. Typically, the lower two-thirds or more of the alluvial deposits consist of coarse sand and gravel that directly overlie bedrock and form the principal unconsolidated aquifers. A surficial aquifer system is present only along the Ohio River Valley and a few of its tributaries. The shallow, surficial aquifer consists of sand and gravel layers with some clay layers that extend 14 to 82 feet below ground. The site and surrounding area are located in the Wabash

Lowland physiographic province. The Wabash Lowlands are characterized by broad terraced valleys and low till-covered hills with an average elevation of about 500 feet above sea level.

Except for a few private water supply wells, groundwater use at the site and the surrounding areas is minimal and is primarily used for industrial purposes. The City of Evansville obtains its drinking water from the Ohio River. The Evansville Water Department pumps water from the Ohio River to the Evansville Water Filtration Plant, from which 32 million gallons of treated water per day is distributed to 150,000 customers. Water quality conditions of the Ohio River are monitored regularly by the Ohio River Valley Water Sanitation Commission.

The overall climate of southwestern Indiana is similar to that of the Gulf Coast because of the prevailing southerly winds that push moist, warm air from the Gulf of Mexico. Average temperatures range from 32°F in January to 86°F in July. The average annual rainfall is 42 inches, and the average annual snowfall is 13 inches.

The population of Evansville, Indiana, is approximately 121,000 (U.S. Census 2000). The Jacobsville Neighborhood Soil Contamination site consists of a primarily centralized urban area bordered by agricultural land to the south along the Ohio River.

5.3 Sampling Strategy

Three tiers of sampling were performed during the investigative phase to characterize the Jacobsville Neighborhood Soil Contamination site. IDEM conducted the first tier of sampling in 2001 to determine if the site should be listed on the National Priorities List (NPL). Sampling was limited to the top six inches of soil at residential properties in close proximity to the Evansville Plating Works site. The sampling resulted in the Jacobsville Neighborhood Soil Contamination site being listed on the NPL. IDEM defined the site boundary as bounded to the west by Edgar Street, to the south by the Lloyd Expressway, to the east by Heidelbach Street, and to the north by Iowa Street (IDEM boundary). The IDEM site boundary is approximately equal to the OU1 site boundary (see Figure 1).

U.S. EPA performed four rounds of sampling to define the areal extent of contamination at the site. To accomplish this, 250-, 500-, and 750-meter grid sampling designs were centered on the IDEM site boundary and extended out three to four miles. Once the areal extent of contamination had been defined, a 250-meter grid sampling design was used in areas that had been shown to have lead concentrations above 400 ppm to better define the spatial distribution of contamination. This sampling was performed during four separate field events during December 2004, April 2005, October 2005, and October 2006.

The third tier of sampling, referred to as the RI sampling, was performed by the U.S. EPA contractor, CH2M Hill, to define the depth of the contamination, collect samples for use in the risk assessment, and evaluate contaminant fate and transport. The results of this third tier of sampling are presented in the RI report (September 2006). During the RI, samples were collected from 28 residential properties near the OU1 area, 75 high access properties in OU1 and OU2, and 12 background locations.

Field investigations as part of the RI included the following:

- Site reconnaissance activities, including coordinating access with property owners and identifying sampling locations not identified during office reconnaissance.
- Soil sampling from residential areas, including focused sampling after the areal extent of contamination had been defined.
- Soil sampling from high-access properties (such as day care centers, playgrounds, and vacant lots) and background locations.
- Data collection on soil from properties that were used to evaluate contaminant fate and transport and remedial alternatives.
- Sediment and surface water sampling from tributaries within the affected areas and reaches of the same tributaries upstream of assumed impacted areas.
- Groundwater sampling from wells that were potential drinking water sources within the defined area.
- Ecological assessment.
- Documentation of sample locations using Global Positioning System (GPS) equipment.
- Definition of the nature and extent of contamination in soil, sediment, surface water, and groundwater to support the assessment of potential risk to human health and the environment and to assist in the evaluation of potential remedial alternatives.

5.4 Source of Contamination

As discussed in Section 2.1 of this ROD, the lead and arsenic found at the Jacobsville Neighborhood Soil Contamination site most likely originated from four, and possibly as many as nine, former facilities that operated foundries. The four foundries that have been identified to date are Blount Plow Works (operated from the 1880s to about the 1940s), Advance Stove Works (operated from the turn of the century to about the 1950s), Newton-Kelsay (operated from the turn of the century to about the 1950s), and Sharpes Shot Works (operated from the 1870s to an unknown date (prior to 1950)) (Figure 2). The facilities were located within or near the OU1 boundaries.

In addition to the nine foundries discussed above, there is also a possibility that Evansville Plating Works may have contributed to the contamination. The company, which began operations in 1897, plated parts using zinc, brass, nickel, copper, iron black (iron oxide), cadmium, and chromium for individuals and industry. Evansville Plating Works was located at 100 West Indiana Street, just south of the Jacobsville neighborhood.

Lead and arsenic are commonly found near foundry operations. Historic photos of the area indicate that the foundries operated outdoors, allowing dust from the operations to be released into the air in large quantities. The foundry dust, containing lead and arsenic, contaminated residential soils by wind dispersion. This is supported by the fact that the extent of contamination is consistent with the wind patterns in Evansville.

5.5 Types of Contaminants and Affected Media

At the Jacobsville Neighborhood Soil Contamination site, surface water, groundwater, sediment, and soil were analyzed for target analyte list (TAL) inorganics. The results were carefully evaluated in the human health and ecological risk assessments to determine the Contaminants of Potential Concern (COPCs), which revealed which of these chemicals and affected media were most important in driving potential risk at the site. These findings are summarized in Section 7 of this ROD, but extensive evaluation is found in the RI report. Human health and ecological risk assessments were completed using site data, and the Contaminants of Concern (COCs) at the site were determined to be lead and arsenic in residential soils.

5.6 Extent of Contamination

5.6.1 Soil Investigations

A total of 189 five-point composite soil samples were collected by IDEM in 2001 as part of the site investigation for Jacobsville Neighborhood Soil Contamination site. All samples were analyzed on-site using a portable x-ray fluorescence (XRF) unit, and 57 samples were sent to a laboratory for verification of XRF results.

Four hundred twenty-two soil samples were collected during the four U.S. EPA sampling events in 2004, 2005, and 2006. The samples were five-point composite samples collected from either the front or back lawns of residential properties, parks, or recreational areas. An XRF unit was used for in-field analysis of the samples, and twenty percent of the samples were also sent to a lab for verification of the XRF results. The ability of the XRF to detect arsenic was limited because the presence of lead masks the arsenic if the lead levels are greater than ten times the arsenic levels. However, all arsenic was found to be co-located with lead in all samples when it was detected, so the areal extent of contamination for lead encompasses the entire areal extent of contamination for arsenic. The areal extent of the contamination encompassed approximately 5 square miles, centered near the four facilities thought to be responsible for the lead and arsenic contamination and consistent with the historical wind patterns of Evansville.

During the January 2006 RI sampling event, conducted by CH2M Hill, after the areal extent of contamination had been defined, 213 soil samples were collected from within the RI sampling boundaries to use in the risk assessments and twelve samples were collected outside of the RI sampling boundaries to serve as background locations.

5.6.2 Background Levels

During the RI in 2006, twelve samples were collected as background samples from a depth interval of 0 to 2 inches below ground surface (bgs). Four of the samples were analyzed for arsenic, lead, and iron, and the remaining eight samples were analyzed for TAL inorganics. The background threshold statistic for the study was the 95 percent/95 percent background upper tolerance limit (UTL), that is, an upper bound (with 95 percent confidence) of the background 95th percentile. The calculation of the UTLs and other summary statistics were based on the complete background data set without excluding any detected concentrations. Outlier tests were performed on the background data set, in accordance with U.S. EPA guidance, and it was determined that no data would be excluded as outliers. Three metals were found to have background concentrations above typical background concentrations: lead, arsenic, and iron. The site-specific background concentrations for these metals are 277 ppm, 16.9 ppm, and 30,400 ppm, respectively.

5.6.3 Summary of Previous Investigations

Soil sample results from IDEM, U.S. EPA and CH2M Hill sampling are summarized in Tables 1 and 2. The results that are summarized in the tables are from samples collected during the IDEM sampling event in 2001, the four U.S. EPA Site Characterization sampling events, the remedial investigation/risk assessment sampling by CH2M Hill in 2006, and the remedial design sampling by CH2M Hill in 2008. Table 1 summarizes the results on a per sample basis, and Table 2 summarizes them on a per property basis. Samples or properties with results above the cleanup levels of 400 ppm for lead and 30 ppm for arsenic, along with the range and average of lead and arsenic concentrations, are summarized according to the following classifications:

- Property class including residential, high-access, and commercial/industrial
- Property location including OU1; OU2; the TBD area; and properties outside OU1, OU2, and the TBD area
- Type of high-access property including park, playground, and daycare

For the summaries in these two tables, it should be noted that screening for arsenic concentrations in soil using an XRF instrument can be inadequate when lead is present in the soil because of limitations in XRF resolution. When lead to arsenic concentrations in soil are 10 to 1 or more, the lead peak will overwhelm the arsenic peak, and so the XRF instrument cannot calculate concentrations of arsenic accurately. Often undetected arsenic concentrations are present at concentrations above the cleanup level of 30 ppm. In this case, the sample was included in the summary as a non-detection, and the numeric detection limit was used when averaging the contaminant concentrations. Other assumptions used when assembling the data for these tables include:

- Quality control/quality assurance field duplicate samples from the remedial investigation and remedial design sampling events were not included in the data summary. In some cases, IDEM and U.S. EPA reported the field duplicate sample result instead of using the primary sample result. If a field duplicate sample was included from an IDEM or U.S. EPA sampling event, the primary sample was not included.
- XRF and analytical laboratory samples were not segregated in the summary.
- If multiple XRF instrument readings were recorded for one sample, the average of the XRF readings was used in the data summary.

__Table 1. Summary of Data from IDEM, U.S. EPA, RI and RD Sampling Events on a Per Sample Basis, Jacobsville Neighborhood Soil Contamination Site.__

Summary of Soil Results on a Per Sample Basis
Summary of Historical Data

Class/Location	Samples Analyzed[a] for Lead	Samples Exceeding Lead Criterion[b]	Range of Lead Concentrations (mg/kg)	Average Lead Concentration (mg/kg)	Samples Analyzed[a] for Arsenic	Samples Exceeding Arsenic Criterion[c]	Range of Arsenic Concentrations (mg/kg)	Average Arsenic Concentration (mg/kg)
Residential								
OU1	1,114	359	20–8,210	373.5	942	28	ND–92	15.2
OU2	300	94	ND–7,910	403.4	293	21	ND–68.2	23.3
Gap Area	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Outside[d]	108	0	ND–369	99.1	107	3	ND–46.5	8.8
High-Access								
OU1	30	2	63–411	193.1	25	1	ND–45	15.7
Daycare	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Park	1	0	217	217	0	not applicable	not applicable	not applicable
Playground	29	2	63–411	192	25	1	ND–45	15.7
OU2	42	1	23.4–532	118.2	32	0	ND–29.3	10.7
Daycare	10	0	23.4–145	85.2	4	0	10.6–13	11.3
Park	9	0	56.9–182.8	99.4	7	0	ND–29.3	13.6
Playground	23	1	30–532	140	21	0	4.1–18.2	9.9
Gap Area	1	0	42	42	1	0	ND	ND
Daycare	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Park	1	0	42	42	1	0	ND	ND
Playground	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Outside[d]	53	2	ND–1,520	99.6	45	0	ND–12.9	8.8
Daycare	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Park	41	2	ND–1,520	114	35	0	ND–12.9	9

Table 1. Summary of Data from IDEM, U.S. EPA, RI and RD Sampling Events on a Per Sample Basis, Jacobsville Neighborhood Soil Contamination Site.

Summary of Soil Results on a Per Sample Basis
Summary of Historical Data

Class/Location	Samples Analyzed[a] for Lead	Samples Exceeding Lead Criterion[b]	Range of Lead Concentrations (mg/kg)	Average Lead Concentration (mg/kg)	Samples Analyzed[a] for Arsenic	Samples Exceeding Arsenic Criterion[c]	Range of Arsenic Concentrations (mg/kg)	Average Arsenic Concentration (mg/kg)
Playground	12	0	16.2–132	53.9	10	0	0.3–11.8	8.3
Commercial/Industrial								
OU1	13	3	50–606	297	1	0	ND	ND
OU2	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Gap Area	3	0	106.12–118.13	110.4	3	0	ND–25.7	5.5
Outside[d]	4	0	ND–157.21	89.5	4	0	ND–0.20	0.20

[a]See Data Assumption in Section 3. Samples may have been screened using an XRF instrument or analyzed in an analytical laboratory.
[b]Criterion for lead is 400 mg/kg.
[c]Criterion for arsenic is 30 mg/kg.
[d]Includes samples located outside OU1, OU2, and the Gap Area

ND–Concentration is below detection.

Table 2. Summary of Data from IDEM, U.S. EPA, RI and RD Sampling Events on a Per Property Basis, Jacobsville Neighborhood Soil Contamination Site.

Summary of Soil Results on a Per Property Location Basis
Summary of Historical Data

Class/Location	Samples Analyzed[a] for Lead	Samples Exceeding Lead Criterion[b]	Range of Lead Concentrations (mg/kg)	Average Lead Concentration (mg/kg)	Samples Analyzed[a] for Arsenic	Samples Exceeding Arsenic Criterion[c]	Range of Arsenic Concentrations (mg/kg)	Average Arsenic Concentration (mg/kg)
Residential								
OU1	252	168	20–8,210	373.5	130	24	ND–92	15.2
OU2	296	92	ND–7,910	403.4	291	21	ND–68.2	23.3
Gap Area	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Outside[d]	106	0	ND–369	99.1	105	3	ND–46.5	8.8
High-Access								
OU1	7	2	63–411	193.1	3	1	ND–45	15.7
Daycare	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Park	1	0	217	217	0	not applicable	not applicable	not applicable
Playground	6	2	63–411	192	3	1	ND–45	15.7
OU2	26	1	23.4–532	118.2	20	0	ND–29.3	10.7
Daycare	5	0	23.4–145	85.2	2	0	10.6–13	11.3
Park	7	0	56.9–182.8	99.4	6	0	ND–29.3	13.6
Playground	14	1	30–532	140	12	0	4.1–18.2	9.9
Gap Area	1	0	42	42	1	0	ND	ND
Daycare	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Park	1	0	42	42	1	0	ND	ND
Playground	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Outside[d]	29	2	ND–1,520	99.6	24	0	ND–12.9	8.8
Daycare	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Park	21	2	ND–1,520	114	17	0	ND–12.9	9

Table 2. Summary of Data from IDEM, U.S. EPA, RI and RD Sampling Events on a Per Property Basis, Jacobsville Neighborhood Soil Contamination Site.

Summary of Soil Results on a Per Property Location Basis
Summary of Historical Data

Class/Location	Samples Analyzed[a] for Lead	Samples Exceeding Lead Criterion[b]	Range of Lead Concentrations (mg/kg)	Average Lead Concentration (mg/kg)	Samples Analyzed[a] for Arsenic	Samples Exceeding Arsenic Criterion[c]	Range of Arsenic Concentrations (mg/kg)	Average Arsenic Concentration (mg/kg)
Playground	8	0	16.2–132	53.9	7	0	0.3–11.8	8.3
Commercial/Industrial								
OU1	13	3	50–606	297	1	0	ND	ND
OU2	0	not applicable	not applicable	not applicable	0	not applicable	not applicable	not applicable
Gap Area	3	0	106.12–118.13	110.4	3	0	ND–25.7	5.5
Outside[d]	4	0	ND–157.21	89.5	4	0	ND–0.20	0.20

[a]See Data Assumption in Section 3. Samples may have been screened using an XRF instrument or analyzed in an analytical laboratory.
[b]Criterion for lead is 400 mg/kg.
[c]Criterion for arsenic is 30 mg/kg.
[d]Includes samples located outside OU1, OU2, and the Gap Area

ND–Concentration is below detection.

5.6.4. Residential Properties

Based on the sampling events summarized in Tables 1 and 2, lead concentrations greater than 400 ppm were observed in soil in 67 percent of residential properties sampled in OU1. This is slightly less than the 72 percent of residential properties requiring remediation in OU1 based on Phase I remedial design sampling. This may be due to the inclusion of Site Characterization 2 samples collected by U.S. EPA, since the object of the sampling plan was to determine the areal extent of contamination by determining where contamination was not present instead of where it was present. Arsenic concentrations greater than 30 ppm were observed in 19 percent of residential properties sampled in OU1.

Lead concentrations greater than 400 ppm were observed in 31 percent of residential properties sampled in OU2. This is slightly less than the 39 percent of residential properties estimated to require remediation in OU2, as presented in the *Final Feasibility Study for Operable Unit 2, Jacobsville Neighborhood Soil Contamination* (CH2M HILL 2009). October 2006 data sampled by U.S. EPA (Site Characterization 4) were not included in the feasibility study estimate and may account for the difference in the percentages. Arsenic concentrations above 30 ppm were observed in seven percent of residential properties sampled in OU2. No residential properties were sampled in the TBD area.

Samples collected from residential properties outside OU1, OU2, and the TBD area did not exhibit lead concentrations greater than 400 ppm. Arsenic concentrations greater than 30 ppm were observed in three percent of the residential properties, or three properties, sampled outside OU1, OU2, and the TBD area. The observed concentrations were 34.9 ppm, 37.1 ppm, and 46.5 ppm. The locations of the properties were highly varied and did not suggest a trend in areal extent, so it is not believed that these observations are site-related.

5.6.5 High Access Properties

During the RI sampling event in 2006, 75 samples were collected from potentially high access properties (parks, playgrounds, day care facilities, and vacant lots that would easily accessible by children). The soil samples were collected at an interval of 0 to 2 inches below ground and analyzed for lead, arsenic, and iron. Only two high access properties were found to have elevated levels of lead, one was found with an elevated level of arsenic, and no high access properties were found to have elevated levels of iron. Lead was detected at concentrations ranging from 9.3 J to 1,520 ppm. The cleanup level of 400 ppm was exceeded at SB-047 (1,520 ppm) and SB-069 (532 ppm). SB-047 was located more than two miles from the area where the original four foundries were located and was determined to not be related to the site. SB-069 was located within the OU2 boundaries and will be included in the cleanup. Arsenic was detected at concentrations ranging from 4.1 to 18.2 ppm, which are below the cleanup level for arsenic.

5.6.6 Groundwater Results

During the RI, eleven drinking wells were sampled. Two of the wells were within the remedial investigation sampling boundaries but outside of the OU1 and OU2 boundaries. One of the wells was a backup industrial well one mile west of where the former foundries were located, and the other was a private drinking water well located about 2.5 miles southeast of where the former foundries were located. The other nine wells were sampled to establish background concentrations. Groundwater samples were analyzed for arsenic, lead, and iron, with four of the samples analyzed for TAL inorganics. No exceedences of the maximum contaminant levels (MCLs) for lead or arsenic were observed in any wells. Manganese exceeded the screening level of 88 micrograms per liter (µg/L) at one location, the industrial well, at a concentration of 283 µg/L. Therefore, manganese was further evaluated in the human health risk assessment due to additive effects of exposures to heavy metals. No other TAL inorganics exceeded screening levels in the groundwater samples.

5.6.7 Surface Water Results

Ten surface water locations were sampled from various locations in Pigeon Creek during the RI. Two samples were collected from locations upgradient of the site to establish background levels. Surface water samples were analyzed for total (unfiltered) and dissolved (field filtered) inorganics. Hardness as calcium carbonate ($CaCO_3$) was analyzed in six of the surface water samples. Aluminum, barium, cadmium, dissolved cadmium, copper, iron, and manganese were detected in surface water at concentrations exceeding their respective screening levels. All seven of these analytes were also detected at similar concentrations at the background locations, so their presence is probably not site related. Nevertheless, all seven analytes were further evaluated in the risk assessments.

5.6.8 Sediment Results

Ten sediment samples were collected from the same locations as the surface water samples during the RI. Sediment samples were analyzed for TAL inorganics (excluding cyanide). Total organic carbon, pH, and grain size were analyzed in seven of the sediment samples, which were collected to determine physical characteristics of site-specific sediment for use in the ecological risk assessment. Antimony, cadmium, copper, lead, iron, manganese, nickel, silver, and zinc were detected in sediments at concentrations slightly exceeding their respective screening levels. All nine analytes were further evaluated in the risk assessments.

6.0 Current and Potential Future Land and Resource Uses

For purposes of the human health and ecological risk assessments for this site, current and reasonably anticipated future land uses and current and potential beneficial groundwater uses were identified.

Residential properties within the Jacobsville Neighborhood Soil Contamination site boundaries will be remediated as explained in this ROD. There is no indication that the residential properties in OU2 will be rezoned. Therefore it assumed that the future land use at the properties addressed in this ROD will be residential use.

To determine the current groundwater use at the site, a search for groundwater wells within the Jacobsville Neighborhood Soil Contamination site was performed. No drinking water wells were found within the OU2 site boundaries. However, one drinking water well and one backup industrial well were located within the RI sampling boundaries. The City of Evansville receives its water from intakes in the Ohio River. The water is pumped to the Evansville Water Filtration Plant, from which 32 million gallons of treated water per day is distributed to 150,000 customers. Water quality conditions of the Ohio River are monitored regularly by the Ohio River Valley

Water Sanitation Commission. Therefore groundwater is not generally used and is not anticipated to be widely used as a potable water source at the site.

7.0 Summary of Site Risks

A baseline human health risk assessment (HHRA) and an ecological risk assessment (ERA) were prepared for the Jacobsville Neighborhood Soil Contamination site, in order to evaluate potential risks to human health and the environment if no action is taken. To evaluate potential risks to human health from lead, the Integrated Exposure Uptake Biokinetic (IEUBK) model for children was used in the HHRA. This model characterizes current and future threats or risks to human health and the environment posed by lead-contaminated soils at the site. The cleanup level for lead was derived from the results of the IEUBK modeling. To evaluate potential risks to human health from arsenic, a human health risk assessment was performed, consistent with U.S. EPA's Risk Assessment Guidance for Superfund (RAGS) (1989). The reasonable maximum exposure (RME) and central tendency exposure (CTE) were evaluated. The HHRA process characterizes current and future threats or risks to human health and the environment posed by arsenic contaminated soils at the site. Risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline HHRA and ERA for the site. The HHRA and ERA determined that the COCs for the site are lead and arsenic for residential and "other" soils and that cleanup levels of 400 ppm and 30 ppm, respectively, will be protective of human health and the environment at the site for current and future residential use.

In accordance with U.S. EPA guidance on preparing RODs, the information presented here focuses on the information that is driving the need for the response action at the Jacobsville Neighborhood Soil Contamination site and does not necessarily summarize the entire HHRA or ERA. Further information is contained in the risk assessments within the RI report, included in the Administrative Record for this site.

7.1 Summary of Human Health Risk Assessment

The baseline HHRA estimates what risks to human health the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline HHRA. More detailed information can be found in the RI report.

The approach used in the HHRA relies on Tier I screening-level evaluations to identify media and exposure pathways that may pose unacceptable risks. More detailed (Tier II) baseline risk assessments are considered if the Tier I screening level evaluations identify potentially significant risks. The HHRA evaluated the potential risks that could result to people from exposure to the contaminants at the site. The HHRA conducted at this site is consistent with U.S. EPA's Risk Assessment Guidance for Superfund (RAGS) and other supplemental guidance to evaluate human health risks. The HHRA identified possible receptors and potentially complete pathways of exposure. The information used in the HHRA helped define site-specific risk-based screening levels (RBSLs).

7.2 Identification of Contaminants of Concern

TAL inorganics were sampled in soil, groundwater, surface water, and sediment in and around the site. Chemicals of potential concern (COPCs) were identified for soil, groundwater, and surface water using human health RBSLs. The following were identified as COPCs for the Jacobsville Neighborhood Soil Contamination site:

- Surface soil--residential: arsenic, iron, and lead
- Surface soil--day care centers: arsenic and iron
- Surface soil--other (playgrounds, parks, ballfields, vacant lots): arsenic, iron, and lead
- Groundwater--private drinking water well: none
- Groundwater--backup industrial well: manganese
- Surface water--Pigeon Creek: cobalt, iron, lead, manganese, and mercury
- Sediment--Pigeon Creek: none

The maximum detected concentrations of the COPCs at each of the three soil exposure settings (residential, day care centers, and "other" properties) were used as exposure point concentrations (EPCs) for residents. This approach is appropriate since soil samples were collected from individual properties and a resident at the maximally affected property in each soil grouping could contact soil with those maximum COPC concentrations rather than concentrations averaged over multiple properties.

The detected concentration of manganese in the one groundwater sample collected from the backup industrial water well was used as the EPC for groundwater at the industrial property.

The 95 percent upper confidence limit (UCL) on the mean concentration of each surface water COPC was used as the EPC in surface water unless it exceeded the maximum detected concentration. The 95 percent UCLs were calculated using the most recent version of ProUCL (Version 3.00.02).

The EPCs in fish were modeled based on the calculated surface water EPCs and bioaccumulation factors available in U.S. EPA's Estimation Program Interface (EPI) software.

A chemical was identified as a COPC even if detected concentrations were within background levels. Potential excess lifetime cancer risks (ELCRs) and hazard indexes (HIs) were calculated using the COPCs. Contaminants above the recommended ELCRs and HIs that were also above background levels were retained as contaminants of concern (COCs). Lead and arsenic in residential and "other" soils were identified as COCs for the Jacobsville Neighborhood Soil Contamination site.

Data quality objectives were met for the risk assessment sampling, as described in the RI report. Analytical data were available from soil, groundwater, surface water, and sediment samples collected during the RI field investigation. Soil analytical data from previous sampling events were not used in the risk assessments because soil samples were not sieved per U.S. EPA guidance. Risk assessment soil samples were collected from the 0 to 2 inch interval at residential, day care centers, and other properties. The samples (including those collected from drip zone areas) were used in the HHRA because they represent the soil most likely to contain higher inorganic concentrations. The sieved part of the sample is the part most likely to be retained on a person's skin, which may lead to absorption and accidental ingestions. Background soil samples available from 12 locations outside the U.S. EPA sampling boundary were used to characterize background soil quality nearby. Upper tolerance limits were calculated for arsenic, iron, and lead concentrations in background soil, as discussed in Section 5.6.2. Groundwater, surface water, and sediment sample data, including background sample data, were all within the data quality objectives for the project.

A summary of the COC data is presented in Table 3.

Table 3. Summary of Chemicals of Concern for the Jacobsville Neighborhood Soil Contamination Site.

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Soil
Exposure Medium: Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Residential Soil On-Site Contact	Arsenic	4.8	31.2	ppm	25/25	31.2	ppm	MAX
	Lead (IEUBK model)	20	8210	ppm	25/25	8210	ppm	MAX
Day care Soil On-Site Contact	Arsenic	9.6	13.4	ppm	7/7	13.4	ppm	MAX
	Lead (IEUBK model)	23.4	145	ppm	7/7	145	ppm	MAX
"Other" Soil On-Site Contact	Arsenic	4.1	18.2	ppm	70/70	18.2	ppm	MAX
	Lead (IEUBK model)	9.3	1520	ppm	70/70	1520	ppm	MAX

Key
ppm: parts per million (mg/kg)
MAX: Maximum Concentration
Other: Other high access properties including playground, ballfield, park, library, gravel lot, and "other"

The table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in soil at residential, day care centers, and "other" properties (i.e., the concentration that will be used to estimate the exposure and risk for each COC in the soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site for the HHRA), the exposure point concentration (EPC), and how the EPC was derived. The table indicates that arsenic and lead were detected at the same frequency at the site, however, lead was detected at levels of concern at a much higher frequency than arsenic at the site. The maximum detected concentration was used as the exposure point concentration. This approach is appropriate since soil samples were collected from individual properties and a resident at the maximally affected property in each soil grouping could contact soil with those COC concentrations rather than concentrations averaged over multiple properties.

7.2.1 Exposure Assessment

Various potential exposure pathways were quantitatively evaluated in the HHRA. These pathways are represented in the Conceptual Site Model (CSM) described in Section 5 of this ROD. All potential exposure pathways represented in the CSM were evaluated to determine if they were complete pathways at this site. Exposure point concentrations (EPCs) were calculated for the COPCs in each data grouping and used in estimating potential intakes and risks for the following receptors:

- Current/Future Residential Adult and Child (residential setting) – Ingestion, dermal contact, and inhalation of surface soil.
- Current/Future Residential Adult and Child (day care setting) – Ingestion, dermal contact, and inhalation of surface soil.
- Current/Future Residential Adult and Child ("other" setting) – Ingestion, dermal contact, and inhalation of surface soil.
- Current/Future Industrial Worker – Ingestion of groundwater from the backup industrial water well. Dermal contact exposures were not quantified because tap water likely would be used for only occasional, brief hand washing or showering at work, and the COPC (manganese) would not be a significant concern for these types of exposures.
- Current/Future Adolescent Recreator – Dermal contact with surface water in Pigeon Creek.
- Current/Future Adult Angler – Ingestion of fish caught in Pigeon Creek.

Although both adult and child scenarios were calculated for the residential scenarios, the IEUBK model for children was used, therefore addressing the higher sensitivity of children to lead exposure. Default exposure values from U.S. EPA human health risk assessment guidance documents were used in the risk calculations for this site.

To identify a site-specific soil exposure frequency, the climate conditions related to exposure to bare soil within the sampling boundary were evaluated. Several sources of meteorological data were consulted. The data indicate that snow cover is not extensive in Evansville. Therefore, the mean number of days with snowfall or precipitation was evaluated. The mean number of days in a year with snowfall of 1 inch or more for Evansville is 13.7, with the maximum in a month being January with 4.4 days. The average month of the first 1-inch snowfall is December, and the average month of the last 1-inch snowfall is March. Similarly, the average high temperature is above freezing each month. Therefore, it was assumed that there is no continuous snow cover or frozen ground in the area and that the number of days of snowfall is included in the number of rainy days. There are, on average, 115 days with rainfall for the year. Thus, there are 250 days where there would be expected to be no snow cover and no precipitation during which time there could be exposure to bare soils by residents. The 250 days per year of exposure was used in both the IEUBK model and arsenic risk assessment calculation.

7.2.2 Toxicity Assessment

The residential and industrial scenarios are most likely long term exposures, so chronic and subchronic exposure values were used in these risk scenarios. A conservative approach was used with the recreator and angler scenarios, and chronic and subchronic exposure values were used in these risk scenarios as well. A summary of the toxicity assessment is presented in Tables 4 and 5.

The following hierarchy of sources was used to obtain toxicity data for COPCs in soil, groundwater, and surface water within the sampling boundary:

- Integrated Risk Information System (U.S. EPA, 2006)
- Provisional Peer-Reviewed Toxicity Values (U.S. EPA Region 9, 2004)
- Health Effects Assessment Summary Tables (U.S. EPA, 1997)

The available toxicity data indicate that the following COPCs have non-carcinogenic effects on primary target organs and were therefore evaluated as such:

- Arsenic, Oral/Dermal – Skin (chronic and subchronic)
- Mercury, Oral/Dermal – Immune system (chronic and subchronic)
- Manganese, Inhalation – Neurological (chronic)

A chemical was identified as a COPC even if detected concentrations were below background levels. Potential excess lifetime cancer risks (ELCRs) and hazard indexes (HIs) were calculated using the COPCs. ELCRs were calculated for the adult/child carcinogenic exposure scenario using the default exposure duration of 70 years. The HI for the adult non-carcinogenic exposure scenario was calculated using the default exposure duration of 24 years. The HI for the child non-carcinogenic exposure scenario was calculated using the default exposure duration of 6 years. Contaminants above the recommended ELCRs and HIs that were also above background were retained as contaminants of concern (COCs). Lead and arsenic in residential and "other" soils were identified as COCs for the Jacobsville Neighborhood Soil Contamination site.

Table 4. Cancer Toxicity Data Summary for the Jacobsville Neighborhood Soil Contamination Site

Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date
Arsenic	1.5	1.5	$(mg/kg\text{-}day)^{-1}$	A	IRIS	05/01/2006
Lead	NA	NA	NA	B2	IRIS	05/01/2006

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/Cancer Guideline Description	Source	Date
Arsenic	0.0043	$(\mu g/m^3)^{-1}$	15	$(mg/kg\text{-}day)^{-1}$	A	IRIS	05/01/2006
Lead	NA	NA	NA	NA	B2	IRIS	05/01/2006

Key

EPA Group:
NA: Not available
IRIS: Integrated Risk Information System, U.S. EPA

- A- Known Human Carcinogen
- B1- Probable human carcinogen—indicates that limited human data are available
- B2- Probable human carcinogen—indicates sufficient evidence in animals and inadequate or no evidence in humans
- C- Possible human carcinogen
- D- Not classifiable as a human carcinogen
- E- Evidence of Noncarcinogenicity

This table provides carcinogenic risk information which is relevant to the contaminants of concern in soil. At this time, slope factors are not available for lead for oral, dermal, or inhalation routes of exposures. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed vial the oral route. An adjustment factor of 95% was used for arsenic. Therefore, a slightly lower value than is presented above was used as the dermal carcinogenic slope factor for arsenic.

Table 5. Non-Cancer Toxicity Data Summary for the Jacobsville Neighborhood Soil Contamination Site

Non-Cancer Toxicity Data Summary									
Pathway: Ingestion, Dermal									
Chemical of Concern	Chronic/ Subchronic	Oral Rfd Value	Oral RfD Units	Dermal RfD Value	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ
Arsenic	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3/1	IRIS	05/01/2006
Arsenic	Subchronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	HEAST	07/31/1997
Lead	Chronic/ Subchronic	NA	NA	NA	NA	NA	NA	NA	NA
Pathway: Inhalation									
Chemical of Concern	Chronic/ Subchronic	Inhalation RfC Value	Inhalation Rfc Units	Inhalation RfD Value	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC:RfD: Target Organ	Dates of RfD: Target Organ
Arsenic	Chronic/ Subchronic	NA	NA	NA	NA	NA	NA	NA	NA
Lead	Chronic/ Subchronic	NA	NA	NA	NA	NA	NA	NA	NA

Key
EPA Group:
NA: Not available
IRIS: Integrated Risk Information System, U.S. EPA
HEAST: Health Effects Assessment Summary Tables, U.S. EPA

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil. At this time, RfDs are not available for lead for oral, dermal, or inhalation routes of exposures and arsenic for the inhalation route of exposure. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed vial the oral route. An adjustment factor of 95% was used for arsenic. Therefore, a slightly lower value than was presented above is used as the dermal carcinogenic slope factor for arsenic.

7.2.3 Risk Characterization

For carcinogens, such as arsenic, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk (ELCR) is calculated from the following equation:

Risk = CDI x SF

Where: risk = a unitless probability (e.g., 2×10^{-5}) of an individuals developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure (RME) estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as excess lifetime cancer risk (ELCR) because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to sunlight. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. U.S. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

Where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Because lead does not have a nationally approved reference does (RfD), slope factor, or other accepted toxicological factor which can be used to assess risk, standard risk assessment methods cannot be used to evaluate the health risks associated with lead contamination. U.S. EPA has developed the Integrated Exposure Uptake Biokinetic model for lead in children (IEUBK model) to predict blood lead levels (BLLs) in children exposed to lead. The IEUBK model calculates the probability that a child will have a BLL greater than 10 micrograms of lead per deciliter of blood (μg/dL). BLLs above 10 μg/dL have been directly related to adverse health effects in adults and children. U.S. EPA developed the IEUBK model to assisting in establishing lead cleanup levels at Superfund sites.

The IEUBK model for lead in children was used to evaluate the risks posed to young children as a result of the lead contamination at the Jacobsville site. The IEUBK model was run using site-specific data to predict a lead soil level that will be protective of children and other residents. Site-specific soil concentrations for lead were used in place of model default values. Drip zone samples were included in the IEUBK model calculations.

A bioavailability study was also performed to determine a more specific evaluation of the lead present at the site. Bioavailability is the fraction of lead in the soil matrix that can be absorbed into the bloodstream by a specific exposure pathway. Nineteen samples were collected from residential soils at the site for bioavailability analysis. The results were evaluated for relative and absolute bioavailability. The bioavailability study results are discussed in the next paragraph, and the report is included in the Administrative Record.

A blood lead level study was not conducted at this site because the areas that contained the highest levels of lead have a high percentage of rental properties that experience frequent tenant turnover. However, some lead data was available from the Vanderburgh County Health Department that indicated that there have been BLLs in children within OU1 that were above 10 µg/dL. To protect current and future residents in OU1 and OU2, the IEUBK model was also run using the bioavailability results from the site-specific bioavailability study. This evaluation was used to calculate a range of lead concentrations in the soil that correspond to the U.S. EPA target level of 95 percent of the population with a BLL below 10µg/dL. The range of cleanup levels calculated from the study was from 306 to 467 ppm. Therefore, the default cleanup level for lead in residential soils of 400 ppm is considered protective of human health and will be used for both OU1 and OU2.

After evaluating all COPCs for the appropriate exposure scenarios, only lead and arsenic were retained as contaminants of concern (COCs) due to the current/future residential adult and child (residential setting) and current/future residential adult and child (other setting) scenarios. Non-carcinogenic effects attributable to COPCs other than lead at the site were found to be negligible for all exposure scenarios. Table 4 summarizes the carcinogenic risk summary attributable to the site. The evaluation of the risk scenarios is summarized below.

Residential Setting

Potential ingestion, dermal contact, and inhalation exposures to surface soil COPCs (arsenic, iron, and lead) were quantified for adult and child residents in a residential setting. For the RME to arsenic scenario, an ELCR of 6×10^{-5} and HIs of 0.1 and 1 were calculated for residential setting adult/child, adult, and child receptors, respectively. For the central tendency exposure (CTE) to arsenic scenario, an ELCR of 2×10^{-5} and HIs of 0.05 and 0.5 were calculated for residential setting adult/child, adult, and child receptors, respectively.

Based on the IEUBK model, the predicted BLL concentrations exceeded the target criterion (less than 5 percent of the child population with a BLL greater than 10 µg/dL) at 25 individual residential properties. When averaging all predicted results from the residential yards, the probability of the "neighborhood average" child population having a BLL exceeding 10 µg/dL was 55.6 percent.

Although the ELCR for arsenic did not exceed 1×10^{-4}, it posed an ELCR greater than 1×10^{-6}. No COPCs exceeded an HI of 1. The percentage of the "neighborhood average" child population with a BLL greater than 10 µg/dL exceeded the target of 5 percent. The maximum detected concentrations of arsenic and lead at residential properties exceeded background UTLs for these chemicals. Therefore, arsenic and lead were identified as COCs for adult and child residents at residential properties.

"Other" Properties

Potential ingestion, dermal contact, and inhalation exposures to surface soil COPCs (arsenic, iron, and lead) were quantified for adult and child residents on properties used for "other" purposes (including playgrounds, ballfields, parks, gravel lots, and others). For the RME scenario, an ELCR of 3 x 10^{-5} and HIs of 0.07 and 0.6 were calculated for residential setting adult/child, adult, and child receptors, respectively. For the CTE scenario, an ELCR of 1 x 10^{-5} and HIs of 0.03 and 0.3 were calculated for residential setting adult/child, adult, and child receptors, respectively.

Predicted BLL concentrations based on the IEUBK model exceeded the target criterion on one property. When averaging all predicted results from the "other" properties, the IEUBK model predicted that the probability of the "neighborhood average" child population having a BLL exceeding 10 µg/dL was 0.553 percent.

Although the ELCR for arsenic did not exceed 1 x 10^{-4}, it posed an ELCR greater than 1 x 10^{-6}. No COPCs exceeded an HI of 1. For lead, the percentage of the "neighborhood average" child population with a BLL greater than 10 µg/dL was less than the target of 5 percent. For both lead and arsenic, the maximum detected concentrations at residential properties exceeded background upper tolerance limits (UTLs). Therefore, arsenic and lead were identified as COCs for adult and child residents at "other" properties.

The calculated ELCRs and HIs for RME scenarios used to identify COCs are estimates of potential upper-bound risks that are useful in regulatory decision-making. All assumptions, such as lifetime of exposure and number of days per year of exposure, are conservative estimates. This is done to ensure the cleanup level selected is protective of human health. Also, drip zone samples were included in the risk assessment calculations. Drip zone samples typically contain higher levels of lead, due to lead-based paint on houses or airborne deposition on roofs and subsequent washing into soils in yards. However, when the drip zone samples were removed from the risk analysis, only four fewer residential properties were predicted to exceed the target BLL criterion.

Table 6. Summary of Carcinogenic Risk Characterization for Arsenic at the Site

Risk Characterization Summary—Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult/Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Residential (Yard)	Soil On-Site Adult/Child RME	Arsenic	5.2E-05	NA	5.0E-06	5.7E-05
	Day Care	Soil On-Site Adult/Child RME	Arsenic	2.2E-05	NA	2.1E-06	2.5E-05
	"Other" Properties	Soil On-Site Adult/Child RME	Arsenic	3.1E-05	NA	2.9E-06	3.3E-05
						Total Risk	1.2E-04

Key

NA: Route of exposure is not applicable to this medium

Table 6 provides risk estimates for the significant routes of exposure. These risk estimates are based on a Reasonable Maximum Exposure (RME) scenario and were developed taking into account various assumptions about the frequency and duration of an adult's and/or child's exposure to soil in residential areas, as well as the toxicity of arsenic. The total risk from direct exposure to contaminated soil at this site to a current resident is estimated to be 1.2×10^{-4}. The COC contributing most to this risk level is arsenic. This risk level indicates that if no cleanup action is taken, an individual would have an increased probability of 12 in 100,000 of developing cancer as a result of site-related exposure to COCs.

Table 7. Summary of Non-Carcinogenic Risk Characterization for Arsenic at the Site

Risk Characterization Summary—Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Residential (Yard)	Soil On-Site Child RME	Arsenic	skin	9.5E-01	NA	8.0E-02	1.0E-01
		Ambient Air (Dust)	Arsenic	NA	NA	NA	NA	NA
							Soil Hazard Index Total	1.0E-01
							Receptor Hazard Index	1.0E-01
							Skin Hazard Index	1.0E-01

Key

NA: Route of Exposure is not applicable to this medium

Note: There are non-carcinogenic risks posed by lead at the site, however the risks were quantified using the IEUBK model and are not comparable to HQs, therefore they were not included in this table.

Table 7 provides hazard quotients (HQs) for each route of exposure and the hazard index (HI) (sum of hazard quotients) for all complete routes of exposure based on an RME scenario. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, an HI greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 1 indicates that there is a slight potential for adverse noncancer effects could occur from exposure to contaminated soil containing arsenic. In addition, since the risk from lead is calculated using the IEUBK model, the additive effects can not be evaluated, so there is a higher potential for noncancer effects than indicated by the HI of 1.

7.3 Summary of Ecological Risk Assessment

The baseline ERA estimates what risks the site poses to the ecological receptors at the site if no action were taken. It can provide a basis for taking action and identifies contaminants and ecological receptors that may need to be addressed by the remedial action.

The approach used in the ERA relies on screening level evaluations as described in U.S. EPA ERA guidance. The ERA considers those chemicals that were detected in surface soils, surface water, and sediment. The assessment incorporates both measured and modeled estimates of exposure, the available guidance and published information on the environmental fate and toxicities of the chemicals evaluated, and the expected/known habitats and likely species in the area. As recommended by U.S. EPA guidance, after the screening level ERA, a baseline ERA was performed on the set of contaminants of potential ecological concern (COPECS) from the screening level ERA, with more realistic exposure assumptions. The ERA was performed for the entire site, not specifically for OU1 or OU2. More detailed information is presented in the RI report.

7.3.1 Identification of Contaminants of Potential Ecological Concern

Most samples collected from the site had a majority of TAL metals above ecological screening levels and were evaluated in the screening ERA. The contaminants identified as COPECS and retained for the baseline ERA were arsenic, iron, and lead. The sources used for screening toxicity values used in the baseline ERA are as follows: *Ecological Soil Screening Value for Arsenic*, U.S. EPA Office of Solid Waste and Emergency Response, March 2005, was referenced for flora exposure to arsenic; *Ecological Soil Screening Value for Lead*, U.S. EPA Office of Solid Waste and Emergency Response, March 2005, was referenced for flora and fauna exposure to lead; *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*, U.S. EPA Region 4, website updated November 2001, was referenced for flora exposure to iron; and Efroymson et al. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants*, 1997 Revision, was referenced for fauna exposure to arsenic and iron.

After calculating the ecological Hazard Quotients (HQs) for each COPEC in soil, iron and lead were retained as COPECS for both flora and fauna exposure to soils, and arsenic was retained as a COPEC for flora exposure to soils. The HQs for the evaluated COPEC were: 1.73 for flora exposure to arsenic, 151 for flora exposed to iron, 71.4 for flora exposed to lead, 0.52 for fauna exposed to arsenic, 151 for fauna exposed to iron, and 4.83 for fauna exposed to lead. The range of concentrations detected for the COPECs are 4.14 to 31.2 ppm for arsenic; 9,060 to 30,200 ppm for iron; and 9.3 to 8,210 ppm for lead. Background concentrations for arsenic, iron, and lead were found to be 16.9 ppm, 30,400 ppm, and 277 ppm, respectively. The mean concentrations for arsenic, iron, and lead were found to be 10.7 ppm, 19,000 ppm, and 750 ppm, respectively. The frequency of detection of the COPECs was 103 detected out of 103 samples for arsenic, 103 detected out of 103 samples for iron, and 129 detected out of 129 samples for lead. All data obtained in the January 2006 risk assessment sampling met data quality objectives for the project and was deemed suitable for use. This data is summarized in Table 8.

Table 8. Summary of Chemicals of Potential Ecological Concern for the Jacobsville Neighborhood Soil Contamination Site

Occurrence, Distribution, and Selection of Chemicals of Potential Ecological Concern (COPECs)									
Exposure Medium: Soil									
Chemical of Potential Concern	Minimum Conc.[1] (ppm)	Maximum Conc.[1] (ppm)	Mean Conc.[2] (ppm)	Standard Deviation	Background Conc. (ppm)	Screening Toxicity Value (ppm)	Screening Toxicity Value Source[3]	HQ Value[4]	COPEC flag
Soil Flora Arsenic	4.1	31.2	10.7	4.27	16.9	18.0	EPA1	1.73	Y
Soil Flora Iron	9060	30200	19000	4580	30400	200	EPA2	151	Y
Soil Flora Lead	9.3	8210	750	1470	277	115	EPA3	71.4	Y
Soil Fauna Arsenic	4.1	31.2	10.7	4.27	16.9	60.0	Efroymson	0.52	N
Soil Fauna Iron	9060	30200	19000	4580	30400	200	Efroymson	151	Y
Soil Fauna Lead	9.3	8210	750	1470	277	1700	EPA3	4.83	Y

Key
Conc. = Concentration

Notes
[1]Minimum/maximum detected concentration above the sample quantitation limit (SQL)
[2]Value calculated using ½ reporting limit for nondetects
[3]EPA1 = *Ecological Soil Screening Value for Arsenic*, U.S. EPA Office of Solid Waste and Emergency Response, March 2005
EPA2 = *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*, U.S. EPA Region 4, Website updated November 2001
EPA3 = *Ecological Soil Screening Value for Lead*, U.S. EPA Office of Solid Waste and Emergency Response, March 2005
Efroymson = Efroymson et al. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants*, 1997 Revision
[4]Hazard Quotient (HQ) is defined as Maximum Concentration/Screening Toxicity Value

7.3.2 Exposure Assessment

The environmental setting of the assessment area encompassing the Jacobsville Neighborhood Soil Contamination site consists primarily of residential properties, commercial/industrial properties, and municipal facilities. The Ohio River is the dominant water feature in the region. Evansville is situated in the southwestern part of the state on the north bank of the Ohio River. A levee system protects the City of Evansville during periods of high water.

Pigeon Creek is a perennial stream that enters the sampling boundary from the north and discharges into the Ohio River about 2 miles downstream, at the southern boundary of the sampling limits. Pigeon Creek originates in Princeton, Indiana, 41 river miles upstream from its discharge point, and drains a watershed of 235,000 acres. Within the sampling boundary, the creek is 15 to 75 feet wide and 5 to more than 20 feet deep. When sampling occurred, in January

2006, the water generally was turbid with moderate to slow stream flow. The creek banks are eroded and terraced, and sediment is highly compacted, indicating widely fluctuating flows. Most parts of the creek within the sampling boundary are affected by human activities. Pigeon Creek is a critical component of the levee system protecting the City of Evansville. Riprap along the banks is common where bridges cross the creek. Refuse also litters the banks. There is little to no riparian buffer along most of the creek, with turf grass encroachment up to the banks. In some areas, a forested riparian buffer, composed of willow, silver maple, black gum, American sycamore, green ash, and oak is present. During a site visit in December 2005, waterfowl, fish, invertebrates, frogs, and a beaver were observed.

The ecological terrestrial habitat is limited to maintained/mowed grassy areas and trees interspersed along roadways and in playgrounds/parks. Since the site is almost exclusively in an urban residential area, many of the species local to the area (Southwest Indiana) may not occur in the assessment area or are rare visitors. Nonetheless, the ERA identified 110 species of trees shrubs and ferns, 36 amphibians and reptiles, 101 species of birds, and 30 species of mammals, that may be found in Southwestern Indiana. Two special status species were identified by U.S. Fish and Wildlife Service (U.S. FWS) and 6 species of special status were identified by Indiana Department of Natural Resources (IDNR) that may be found in Southwestern Indiana. More detailed information about these species can be found in the RI report. The most commonly observed birds in the area were the common grackle, European starling, red-winged blackbird, ring-billed gull, mourning dove, Canada goose, and mallard. Mammalian species common in urban settings, such as squirrels, deer, raccoons, skunks, opossums, beaver, mice, rats, and bats are expected to occur in the site. The two species identified by the U.S. FWS are the federally endangered Indiana bat and the federally threatened bald eagle, both of which are in decline in most of Southwestern Indiana. The seven special status species identified by IDNR are Ohio Pigtoe, Hellbender, Great Egret, Peregrine Falcon, Bald Eagle, Indiana Bat, and American Badger, all which are also in decline in most of Southwestern Indiana. More detailed information is presented in the RI report.

Arsenic, iron, and lead were identified as chemicals of potential ecological concern (COPECs) in surface soil as a result of historical activities. Complete exposure pathways exist for terrestrial ecological receptors within the site boundary. Terrestrial animals may be exposed to chemicals in soil by direct contact with the soil, incidental ingestion of soil, and ingestion of contaminated food items for chemicals that have entered food webs. Terrestrial vegetation may be exposed to chemicals by direct contact of roots to soils. Exposure to chemicals present in the surface soil by dermal contact may occur but is unlikely to represent a major exposure pathway for bird and mammal receptors because fur or feathers minimize transfer of chemicals across dermal tissue. Direct contact is a potential exposure route for soil invertebrates. The chemical contribution from the inhalation pathway generally is insignificant for bird and mammal ecological receptors relative to ingestion pathways, and so the air pathway was not considered for ecological receptors. See Figure 7 for a diagram of the Ecological Conceptual Site Model and Table 9 for exposure pathways of concern.

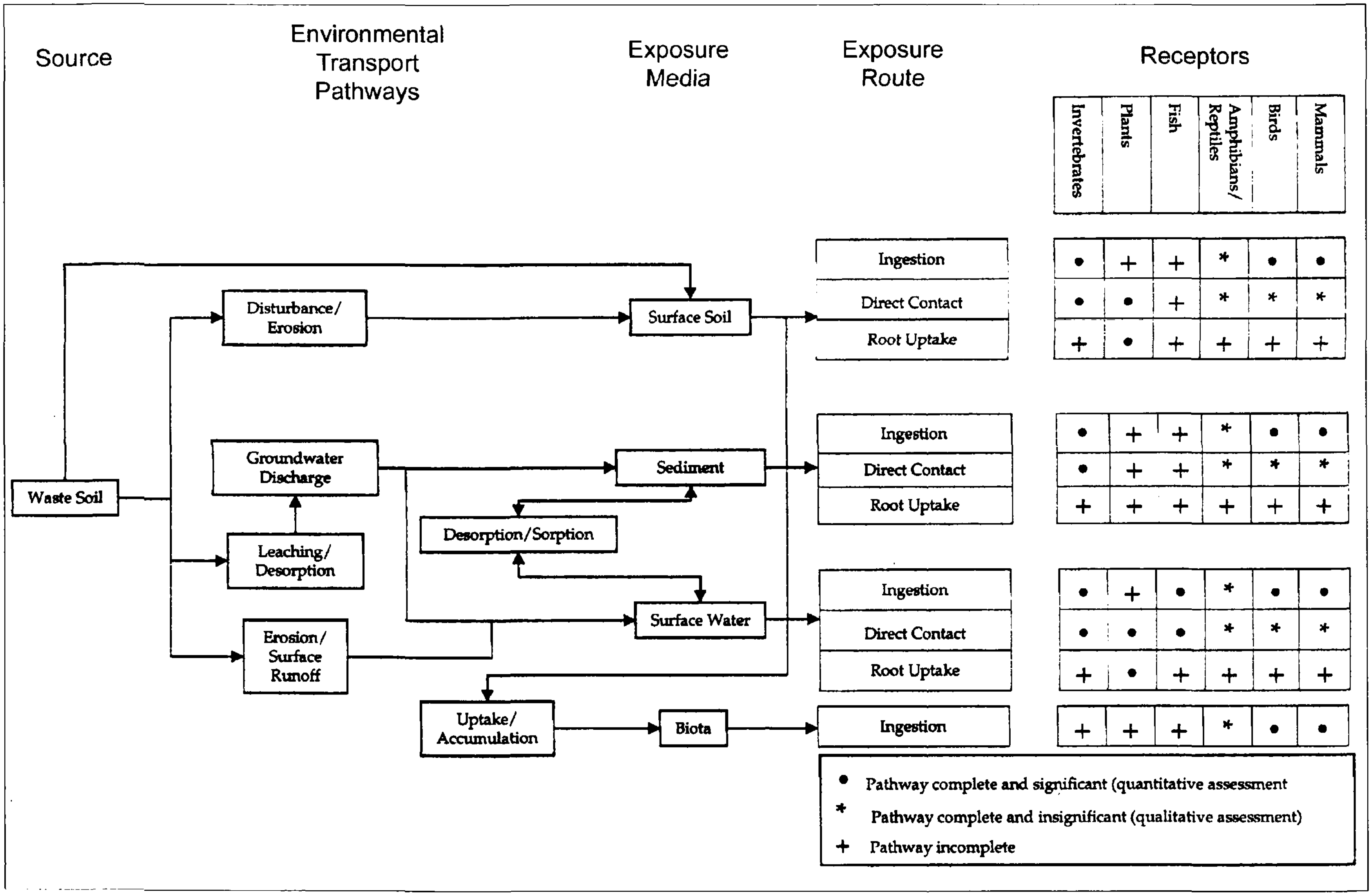

Figure 7. Ecological Conceptual Site Model for the Jacobsville Neighborhood Soil Contamination Site.

Table 9. Summary of Ecological Exposure Pathways of Concern at the Jacobsville Neighborhood Soil Contamination Site

Ecological Exposure Pathways of Concern						
Exposure Medium	Sensitive Environment Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Soil	N	Invertebrates	N	Ingestion, Direct Contact	Survival, growth, and reproduction	Toxicity reference values for soil invertebrates
	N	Plants	N	Direct Contact	Survival, growth, and reproduction	Toxicity reference values for plants
	N	Birds	N	Ingestion	Survival, growth, and reproduction	Literature-derived chronic NOAEL values for survival, growth, and or reproductive effects with modeled dietary exposure doses for American robin, Red-tailed hawk, and Mourning dove
	N	Mammals	N	Ingestion	Survival, growth, and reproduction	Literature-derived chronic NOAEL values for survival, growth, and or reproductive effects with modeled dietary exposure doses for Short-tailed shrew, Meadow vole, and Red fox
Biota (soil)	N	Birds	N	Ingestion	Survival, growth, and reproduction	Literature-derived chronic NOAEL values for survival, growth, and or reproductive effects with modeled dietary exposure doses for American robin, Red-tailed hawk, and Mourning dove
	N	Mammals	N	Ingestion	Survival, growth, and reproduction	Literature-derived chronic NOAEL values for survival, growth, and or reproductive effects with modeled dietary exposure doses for Short-tailed shrew, Meadow vole, and Red fox

Risk estimates in the baseline ERA were based on average (arithmetic mean) chemical concentrations. Central tendency estimates for exposure parameters and for body weight and ingestion rate were used to represent realistic exposure estimates to flora and fauna evaluated in the ERA. Concentrations of chemicals below background levels were not considered in the baseline ERA since they are unlikely to have an impact on the assessment endpoints evaluated in the ERA. The frequency of detection, spatial distribution of exceedances of screening levels, and association of exceedances with habitat quality were also considered in the baseline ERA. Chemicals that had no or few exceedances in suitable habitat or that were spatially isolated were not considered to have population-level effects.

7.3.3 Ecological Effects Assessment

Because average concentrations of arsenic in surface soil (soil flora) and lead in surface soil (soil fauna) were below conservative screening values, risks associated with these chemicals are considered negligible to the community-level assessment endpoints evaluated in the baseline

ERA, and no further investigation was warranted. Iron and lead in surface soil were further evaluated by a comparison to background levels. Sample concentrations of iron in surface soil were below site-specific background levels and therefore were not considered to be site-related. Therefore, no further investigation was warranted.

Concentrations of lead in surface soil exceeded the soil flora screening level (115 ppm) at 71 of 129 locations, with 52 of the samples occurring within the original IDEM site boundary. All samples collected within the OU1 boundary exceeded the soil flora screening level. Outside the OU1 boundary, lead concentrations at 19 sample locations dispersed throughout the site sampling boundary exceeded the soil flora screening level. Concentrations of lead in surface soil above the soil flora screening level and background level (227 ppm) may adversely affect terrestrial plants. Lead can inhibit growth, reduce photosynthesis (by inhibiting enzymes unique to photosynthesis), interfere with cell division and respiration, reduce water absorption and transpiration, accelerate abscission or defoliation and pigmentation, and reduce synthesis of chlorophyll and adenosine triphosphate. However, at low levels, these effects are likely to be masked by effects from human disturbances and artificial maintenance. The terrestrial plant community at the JNSC site consists of grassy areas and trees interspersed along roadways and in playgrounds/parks and is regularly disturbed and maintained. Sensitive or special-status species (the purple passion flower) are not expected to occur in these areas. Since the highest concentrations will be remediated to the residential cleanup level (400 ppm), additional injury to plants is unlikely. Injury to terrestrial plants on properties within the site sampling boundary has not been observed previously, although investigations specific to this purpose have not been conducted. For these reasons, no further evaluation of the risks to plants from lead was considered necessary.

7.3.4 Ecological Risk Characterization

Arsenic, iron, and lead in surface soil had maximum concentrations or exposure doses that exceeded screening values and were retained as COPECS for further evaluation. However, based on COPEC evaluation using more realistic assumptions, potential risks to terrestrial receptors in the Jacobsville Neighborhood Soil Contamination site is considered negligible.

Risk to special-status birds and mammals (also representative of special-status amphibians and reptiles) are also considered negligible. Screening-level exceedances for birds and mammals were based primarily on high concentrations near the immediate source area.

To confirm that the cleanup levels for lead and arsenic would be protective of songbirds in the area, the relevant portions of the ecological risk assessment were reviewed, and a bounding calculation was performed to assess the effect of alternate and more conservative assumptions. The modeling assumptions and input parameters were reviewed. Because the robin food ingestion rate of 0.0055 kg_{dw}/d could not be verified, a more conservative value of 0.0090 kg_{dw}/d (calculated from data from Levey and Karasov (1989)) was used, which increased the robin food ingestion rate by 64 percent.

Using the modified food ingestion rate described above and a very conservative lead toxicity reference value (TRV) for birds recommended by the U.S. EPA Region 9 Biological Technical

Assistance Group (BTAG) (2/24/09) (www.dtsc.ca.gov/AssessingRisk/upload/Eco_BTAG-mammal-bird-table.pdf), the soil preliminary remedial goal for lead was recalculated using the RI robin exposure model. The Region 9 BTAG high TRV (equivalent to a LOAEL), 8.75 mg lead/kg_{BW}-d for birds, is much lower than the 38.5 mg/kg_{BW}-d LOAEL TRV used in the RI (RI Table 8-30). The soil PRG was then calculated using the following equation:

$$PRG = (TRV - ((WIR * WC) / BW)) / ((FIR / BW) * ((BCF_{plant} * DF_{plant}) + (BAF_{invert} + DF_{invert}) + DF_{soil}))$$

Where: WIR – water ingestion rate, WC – water lead conc., BW – bodyweight, FIR – food ingestion rate, BCF_{plant} – soil-to-plant lead bioconcentration factor, DF_{plant} – dietary fraction of plants, BAF_{invert} - soil-to-invertebrate (earthworm) lead bioaccumulation factor, DF_{invert} – dietary fraction of soil invertebrates, and DF_{soil} – dietary fraction of soil (see RI Table 8-30 for parameter values).

The new calculation resulted in a lead soil PRG of 380 ppm, which represents the upper end of the PRG range for robins calculated with the bounding assumptions. For remedial purposes, this is identical to the human health-based 400 ppm cleanup level, which demonstrates that, even with much more conservative assumptions, the proposed remedy will be acceptably protective for robins.

The RI TRVs for evaluating risk of arsenic to birds (mourning dove – RI Table 8-31) are significantly *more* conservative than the Region 9 BTAG arsenic TRVs for birds. The RI conclusion that there is no elevated risk to birds in residential areas of the site due to arsenic exposure is based on a very conservative assessment. Therefore, the cleanup level selected for arsenic at the site will be protective of songbirds.

Although the residential/urban grassy and treed areas found in the area of the site are not used as habitat by some wildlife, there are some species of wildlife, such as American robins, mourning doves, and squirrels, which are well-adapted to urban/suburban managed habitat patches. The cleanup levels developed in the HHRA are protective of the ecological community at this site.

7.4 Risk Assessment Conclusions

The risk to human health from lead and arsenic in residential soils is driving the need for remedial action for the Jacobsville Neighborhood Soil Contamination site. The response action selected in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare. A summary of the cleanup levels determined for lead and arsenic is shown in Table 10.

Table 10. Summary of Cleanup Levels for the Jacobsville Neighborhood Soil Contamination Site

Cleanup Levels for Contaminants of Concern			
Media: Soil **Site Area:** OU1 **Available Use:** Residential **Controls to Ensure Restricted Use (if applicable):** N/A			
Chemical of Concern	Cleanup Level	Basis for Cleanup Level	Risk at Cleanup Level[1]
Lead	400 mg/kg (ppm)	Risk Assessment/IEUBK model	<5 percent of the child population with a BLL greater than 10 µg/dL
Arsenic	30 mg/kg (ppm)	Risk Assessment/ Background Concentrations	Cancer risk = 1×10^{-4}
Notes The exposure scenarios are for current/future residential for adults and children at residential and "other" high access properties.			

8.0 Remedial Action Objectives and ARARS

8.1 Remedial Action Objectives (RAOs)

Remedial action objectives (RAOs) are goals specific to media or operable units for protecting human health and the environment. Risk can be associated with current or potential future exposures to residential soils. A single RAO was developed for OU2 based in part on the contaminant levels and exposure pathways found to present potentially unacceptable risk to human health as determined in the RI. The RAO, remediation goals, and remediation strategies developed address constituents posing unacceptable risk to residents.

The RAO for the site is to control concentrations of arsenic and lead in residential soil that present a human health risk by minimizing the potential for dermal contact, ingestion, and inhalation exposures. The RAO will be achieved by addressing all residential soils above the risk-based cleanup levels based on site-specific background levels and the HHRA for the site. The cleanup level at the site for lead is 400 ppm, based on the IEUBK modeling of site data. The cleanup level for lead corresponds to less than 5 percent probability of the child population at the site having BLLs above 10 µg/dL, which is the recommended target per U.S. EPA guidance. The cleanup level for arsenic at the site is 30 ppm, based on risk assessments and site background concentrations of arsenic. The cleanup level for arsenic corresponds to an ELCR of 1×10^{-4}, which is within the range required by the National Contingency Plan (NCP).

8.2 Applicable or Relevant and Appropriate Requirements (ARARs)

CERCLA, as amended by SARA, specifies that Superfund remedial actions must comply with the substantive requirements of federal and state environmental laws. Such requirements may be applicable or relevant and appropriate requirements (ARARs). In addition to ARARs, federal and state advisories and guidance documents exist that, although not binding regulations, contain information "to be considered" (TBC). ARARs and TBCs are important in developing remedial objectives that comply with regulatory requirements or guidance (as appropriate). The identification of site-specific ARARs is based on specific constituents at a site, the various response actions proposed, and the general site characteristics. As such, ARARs are classified into three general categories:

Chemical-specific ARARs – specific to the type(s) of constituents, pollutants, or hazardous substances at a site; include state and federal requirements that regulate contaminant levels in various media;

Action-specific ARARs – specific to the cleanup activities being considered; usually technology- or activity-based; regulatory requirements that define acceptable excavation, treatment, and disposal procedures; and

Location-specific ARARs – specific to actions at the geographic location; requirements for contaminant concentrations or remedial activities resulting from a site's physical location (e.g., wetlands or floodplains).

Potentially applicable federal, state and local ARARs and TBCs are summarized in Appendix D.

9.0 Description of Alternatives

Following development of the RAOs, a screening and evaluation of potential remedial alternatives was conducted in accordance with CERCLA and the NCP in the feasibility study (FS) report. Remedial technologies screened for this site can be found in the FS.

The technologies that remained following screening were assembled into remedial alternatives that meet RAOs and satisfy ARARs. The specific details of the remedial components discussed for each alternative are intended to serve as representative examples.

The preliminary remedial alternatives identified for soil are: Alternative 1, No Action; Alternative 2, Soil Excavation, Backfill, and Site Restoration; and Alternative 3, In Situ Treatment and Site Restoration.

For the purpose of this ROD and the remedial action, a residential lot includes properties that contain single- and multi-family dwellings, apartment complexes, schools, day care centers, playgrounds, parks, and vacant lots zoned residential that are near other residential lots, per U.S. EPA guidance. Therefore, this ROD covers residential and high access property designations as presented in the RI report. There are approximately 10,000 residential lots within OU2, and approximately 4,000 (about 40 percent) are expected to require remediation. Only residential lots or high access properties with soil concentrations exceeding 400 ppm lead or 30 ppm arsenic will be addressed by the selected remedy.

9.1 Description of Remedy Components

Each of the alternatives is briefly described below. More detailed information about each of the alternatives can be found in the FS report, which is included in the Administrative Record for the site.

Alternative 1 – No Action

Alternative 1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave affected soil in place at the site. There are no capital or operations and maintenance (O&M) costs associated with Alternative 1. However, the NCP requires five-year reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

Alternative 2—Soil Excavation, Backfill and Site Restoration

Alternative 2 consists of excavating soil with arsenic and lead levels exceeding the site cleanup levels from residential lots and high access properties, offsite disposal at a permitted Subtitle D landfill, backfilling with clean soil, and site restoration. Soil is to be excavated to a maximum depth of 18 inches. Based on results of samples collected during the remedial design for OU1, the area where the original foundries thought to be the source of the contamination were located, 99 percent of the yards show exceedences of cleanup levels within the top 18 inches. This alternative assumes that the excavated soil will not be characterized as hazardous waste based on TCLP results for soil samples collected from OU1. Treatment of the Subtitle D soils is not required prior to disposal and therefore was not evaluated. The excavation will be backfilled with clean fill and top soil, and the property will be restored as close as possible to original conditions. To ensure backfill material is clean, the borrow source vendor will need to test the soil and provide certification that the fill does not contain chemicals at levels that exceed residential screening levels. Institutional controls (ICs) are anticipated for those properties which are contaminated but for which access is not gained for cleanup. An IC that is anticipated is a lead hazard registry that lists the remediation status for every property.

The main components of Alternative 2 include the following:

- Through community outreach, property owners in OU2 will be contacted to gain access to their property to sample the soils (if necessary) and implement the remedy.
- Residential and high access soils within the OU2 boundaries will be sampled down to 18 inches to determine if they contain concentrations of arsenic and/or lead that are greater than the cleanup levels for the site.
- Completion of residential property checklists, taking inventory of vegetation, and collecting photographic documentation of current property conditions outside and potentially inside structures on the property;
- Clearing lots of shrubbery and debris;
- Residential and high access soils containing arsenic and/or lead at concentrations greater than the cleanup levels will have the soils excavated to the depth that the elevated concentrations were found, to a maximum of 18 inches. If physical barriers exist, such as trees, soil excavation will be done around the barrier to the extent

possible. Engineering controls will be implemented in order to prevent exposure to lead and arsenic from dust created by the excavation of the soils. Building foundations, permanent walkways and fixtures will not be affected by the soil excavation.

- Collection of soil samples to verify that the soil is not characteristically hazardous for disposal purposes;

- Transportation and disposal of soil at an approved Subtitle D landfill; if possible, soil will be put to reuse, such as at industrial sites or as daily cover at a landfill;

- Once excavation is complete, clean fill will be placed in the excavated areas and the lawns will be returned to as close to their original condition as possible.

- For properties needing remediation but not granting access for sampling and/or cleanup and for properties which may have contamination above cleanup levels after excavation to 18 inches, institutional controls will be implemented consistent with local, state and federal government authority. It is anticipated that a lead hazard registry will be maintained that lists the remediation status of each property; and

- Whenever possible, cleanup priority will be given to those residents at higher risk, such as homes with children under 7 years of age. In addition, U.S. EPA will work with residents with special needs to ensure the cleanup can proceed without adversely affecting them.

Five-year reviews may be required for Alternative 2 if properties needing remediation cannot be accessed to perform the cleanup.

Alternative 3—In Situ Treatment and Site Restoration

Alternative 3 consists of implementing in situ treatment of the contaminated soil followed by placement of 6 inches of topsoil to establish vegetative growth as part of site restoration. A bench-scale test may be required to determine the proper chemistry of the mixing reagent. One possible reagent that would be used is a product called EnviroBlend®. EnviroBlend® consists of a buffered phosphate that binds with the metals of concern forming compounds that have extremely low solubilities. The magnesia buffer stabilizes the pH of the environment to control leachability and ensure long-term treatment. According to the manufacturer, Enviroblend® effectively treats arsenic, lead, and several other inorganics such as antimony, barium, cadmium, chromium, copper, mercury, nickel, selenium, and zinc and has been used successfully used in over 40 states. Since its development, this technology has effectively treated more than 2 million tons of hazardous waste from a wide range of industries (Premier Chemicals 2006). The reagent can be mixed in place using excavators, discs, and specialized mixing equipment. Soil confirmation samples in the form of toxicity characteristic leaching procedure (TCLP) or synthetic precipitation leaching procedure (SPLP) will be required to determine if treatment is successful. Because additional volume will be added to the soil, some grading operations may be required during installation of top soil to ensure proper drainage during site restoration.

Properties requiring treatment may require disposal of excess treated soil to maintain surface drainage.

Five-year reviews will be required to assess the long-term effectiveness of soil treatment. This will require a site reconnaissance visit and periodic sampling of treated properties.

Alternative 3 has the following main components:

- Gaining access to residential properties;

- Sampling of residential and high access properties that were not sampled during previous sampling rounds to determine the need for remedial actions at the property;

- Completing residential property checklists, taking inventory of vegetation, and collecting photographic documentation of current property conditions outside and potentially inside structures on the property;

- Clearing and soil disturbance to expose soil;

- Performing in situ soil mixing using Enviroblend® or a similar reagent;

- Removing excess soil for offsite disposal as required to maintain drainage or match existing grades;

- Analyzing post-treated soil to verify treatment effectiveness;

- Placement of 6 inches of topsoil on treated areas;

- Restoring the properties as close to original conditions as possible;

- Performing monitoring and five-year reviews;

- For properties needing remediation but not granting access for sampling and/or cleanup and for properties which may have contamination above cleanup levels after excavation to 18 inches, institutional controls will be implemented consistent with local, state and federal government authority. It is anticipated that a lead hazard registry will be maintained that lists the remediation status of each property; and

- Whenever possible, cleanup priority will be given to those residents at higher risk, such as homes with children under 7 years of age. In addition, U.S. EPA will work with residents with special needs to ensure the cleanup can proceed without adversely affecting them.

9.2 Common Elements and Distinguishing Features of Each Alternative

Alternatives 2 and 3 have many common elements. These include gaining access to residential properties, sampling soil at residential properties that have not been sampled previously to determine if the soils need remediation, clearing vegetation prior to remediation, some disruption to residents during construction activities, restoration of properties including reseeding, and institutional controls. Institutional controls will be required for Alternative 2 and Alternative 3 if properties that are contaminated cannot be accessed for cleanup. Both Alternatives 2 and 3 include transportation of excavated soils off-site and management of soils in a RCRA Subtitle D landfill, although Alternative 3 would require much less soil to be transported off-site.

The primary difference between Alternatives 2 and 3 is that Alternative 2 is a proven permanent solution in which soil with contamination above the cleanup levels is removed from the site. However. Alternative 2 does not meet U.S. EPA's statutory preference for a treatment remedy, which permanently and significantly reduces the volume, toxicity or mobility of site contamination. Although offsite transport and disposal without treatment is U.S. EPA's least favored alternative where practicable treatment technologies are available, the public perception of Alternative 2 is expected to be positive because the contaminated soils are efficiently and permanently being removed from the residential properties.

Alternative 3 treatment is expected to be a permanent remedy. However, this technology has not had long-term performance testing to demonstrate that the effects of treatment are long lasting. Long-term management will be required to verify that the Alternative 3 treatment approach remains effective. If it is determined to not be effective, additional treatment may be required. Long-term management is not expected for Alternative 2.

The cost to implement Alternative 2 is approximately $23 million less than the cost for Alternative 3, and construction activities would take less time to complete than for Alternative 3. The estimated net present worth cost is $0 for Alternative 1, $135 million for Alternative 2, and $158 million for Alternative 3. The estimated duration of the remedial action for Alternative 2 is 16 years, and the estimated time for completion of Alternative 3 is at least 20 years. A longer duration may be required for Alternative 3 as bench-scale testing will be required before the remedial action could be implemented.

A commonality between Alternative 1 and 2 is that they do not reduce the toxicity, mobility, or volume of contamination through treatment. However, Alternative 2 would eliminate the risk of exposure to soils above the cleanup levels whereas Alternative 1 would not. The total volume of waste is the same for Alternatives 1, 2 and 3. Alternatives 1 and 3 involve leaving the original soils in place and therefore five-year reviews would be necessary if these alternatives were implemented. Five-year reviews may also be required for Alternative 2 if access cannot be gained to a property where lead and/or arsenic exceed the cleanup levels. Institutional controls will be required for Alternative 1, as well as for Alternatives 2 and 3 for those properties that need remediation but refuse access. For Alternatives 2 and 3, an institutional control in the form of a lead hazard registry is anticipated that would list the remediation status of each property.

9.3 Expected Outcomes of Each Alternative

Since the site use is currently residential, it is reasonable to assume that the properties would continue to be used residentially. If Alternative 1 is implemented, residents would continue to be exposed to levels of lead and arsenic that pose unacceptable risk to adults and children. If Alternatives 2 or 3 are implemented, the residents at the properties will not be exposed to unacceptable levels of lead and arsenic which will allow for residential, recreational or commercial use of the properties.

There is no risk from exposure to groundwater regardless of the alternative that is implemented.

If Alternative 1 is selected, the area in and around OU2 will likely not change in character and will continue to have the negative association of soil contamination. If Alternative 3 is implemented, there may still be negative associations attached to the area because the contamination will remain in the soils, even though it will no longer pose a risk to human health or the environment. If Alternative 2 is implemented, the association of the area with lead and arsenic contamination will be eliminated. This may facilitate the redevelopment and revitalization of the area.

9.4 Preferred Alternative

The preferred alternative described in the Proposed Plan for the Jacobsville Neighborhood Soil Contamination site is Alternative 2. The estimated cost of the preferred alternative is $135 million.

10.0 Summary of Comparative Analysis of Alternatives

This section explains U.S. EPA's rationale for selecting an alternative. U.S. EPA has developed nine criteria to evaluate remedial alternatives to ensure that important considerations are factored into remedy selection decisions. These criteria are derived from the statutory requirements of Section 121 of CERCLA, the NCP, as well as other technical and policy considerations that have proven to be important when selecting remedial alternatives. When selecting a remedy for a site, U.S. EPA conducts a detailed analysis of the remedial alternatives consisting of an assessment of the individual alternatives against each of the nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria. Table 11 summarizes the comparative analysis. The nine evaluation criteria are described in more detail below.

Threshold Criteria

Threshold criteria are standards that an alternative must meet to be eligible for selection as a remedial action. If ARARs cannot be met, a waiver may be obtained where one or more site exceptions occur as defined in the NCP.

Overall Protection of Human Health and the Environment. Protectiveness is the main requirement that remedial actions must meet under CERCLA. It is an assessment of whether each alternative achieves and maintains adequate protection of human health and the environment. A remedy is protective if it eliminates, reduces, or controls all current and potential risks posed by the site through each exposure pathway. Adequate engineering controls, land use controls, or some combination of the two can be implemented to control exposure and thereby ensure reliable protection of human health and the environment over time. In addition, implementation of a remedy cannot result in unacceptable short-term risks or cross-media impacts on human health and the environment. Both Alternatives 2 and 3 would be protective of human health and the environment. Alternative 1 would not be protective of human health and the environment.

Compliance with ARARs. Compliance with ARARs is a statutory requirement of remedy selection. This criterion is used to determine whether the selected alternative would meet the federal, state, and local ARARs identified in Appendix D. Both Alternatives 2 and 3 would be in compliance with ARARs. Alternative 1 would not be in compliance with ARARs.

Primary Balancing Criteria

Balancing criteria are used to weigh tradeoffs between alternatives. These represent the standards upon which the detailed evaluation and comparative analysis of alternatives are based. A high rating on one generally can compensate for a low rating on another.

Long-Term Effectiveness and Permanence. Long-term effectiveness and permanence reflects CERCLA's emphasis on implementing remedies that will protect human health and the environment in the long term. Under this criterion, results of a remedial alternative are evaluated in terms of the risk remaining at the site after response objectives are met. The primary focus of the evaluation is the extent and effectiveness of the actions or controls that may be required to manage the risk posed by treatment residuals or untreated wastes.

Factors to be considered and addressed are magnitude of residual risk, adequacy of controls, and reliability of controls. Magnitude of residual risk is the assessment of the risk remaining from untreated waste or treatment residuals after remediation. Adequacy and reliability of controls is the evaluation of the controls that can be used to manage treatment residuals or untreated wastes that remain onsite.

Alternative 1 would not be effective in either the short or long term. Alternative 2 would provide long-term effectiveness and permanence because the contaminated soil would be removed from the site permanently. The long-term effectiveness and permanence of Alternative 3 have not been sufficiently tested to say with certainty that the in situ treatment would offer a permanent solution. For Alternative 3, testing would have to be done periodically to ensure that the remedy remained effective in the long term.

Reduction of Toxicity, Mobility, or Volume through Treatment. This criterion addresses the statutory preference for remedies that employ treatment to significantly reduce the toxicity, mobility, or volume of the hazardous substances. That preference is satisfied when treatment is used to reduce the principal threats at a site by destroying toxic chemicals or reducing the total mass or total volume of affected media. This criterion is specific to evaluating only how the treatment reduces toxicity, mobility, and volume. Specifically, the analysis will examine the magnitude, significance and irreversibility of reductions. It does not address containment actions, such as capping.

Alternatives 1 and 2 would not offer any reduction in toxicity, mobility or volume through treatment; however, Alternative 3 would satisfy this criterion. The satisfaction of this criterion must be balanced against other criteria like long-term effectiveness and permanence, cost, and State and community acceptance.

Short-Term Effectiveness. This criterion examines the short-term impacts associated with implementing the alternative. Implementation may affect workers, the neighboring community, or the surrounding environment. Short-term effectiveness also includes potential threats to human health and environment associated with excavation, treatment and transportation of hazardous substances; potential cross-media impacts of the remedy; and the time required to achieve protection of human health and the environment.

Alternative 1 would not be effective in the short term. Both Alternatives 2 and 3 would pose the same potential problems in the short term, such as temporary increases in airborne dust, dangers associated with construction and truck traffic, and a temporary inconvenience to residents. Alternative 3 would not generate as much truck traffic as Alternative 2; however, Alternative 2 would take less time to implement than Alternative 3. For both alternatives, engineering controls and safety measures would be implemented to reduce these impacts. Also, U.S. EPA will work with residents to minimize the disruption and inconvenience of either alternative.

Implementability. Implementability considerations include technical and administrative feasibility of the alternatives, as well as the availability of goods and services (including treatment, storage or disposal capacity) associated with the alternative. Implementability considerations often affect the timing of remedial actions (for example, limitations on the season in which the remedy can be implemented, the number and complexity of material handling steps, and the need to secure technical services). Onsite activities must comply with the substantive parts of applicable permitting regulations.

Alternative 1 is readily implemented because it entails taking no action. The technical and administrative feasibility of Alternatives 2 and 3 is similar. The equipment and technology to excavate soil for Alternative 2 and to mix an additive into soil for Alternative 3 are readily available. For both Alternatives 2 and 3, some manual excavation and mixing would have to occur due to the small size of the yards and the presence of physical barriers such as fences.

Cost. The detailed cost analysis of alternatives includes capital and annual O&M costs incurred over a period of 30 years in accordance with U.S. EPA guidance *Guide to Developing and Documenting Cost Estimates During the Feasibility Study.* The focus during the detailed analysis is on the net present worth of these costs. Costs are used to select the most cost-effective alternative that will achieve the remedial action objectives.

The cost estimates are prepared to have accuracy in the range of –30 to +50 percent. The exact accuracy of each cost estimate depends upon the assumptions made and the availability of costing information. Present worth will be calculated assuming the current discount rate established by the Office of Management and Budget.

Alternative 1 has no costs associated with it. The estimated cost for Alternative 2 is $135 million, and the estimated cost for Alternative 3 is $158 million. Alternative 2 will cost approximately $23 million less than Alternative 3.

Modifying Criteria

Modifying criteria are evaluated by addressing comments received after the regulatory agencies and the public have reviewed the FS and Proposed Plan. This evaluation is presented in the Responsiveness Summary, found in Appendix A.

State Acceptance. This criterion evaluates the technical and administrative issues and concerns the state may have regarding the alternatives. This was addressed upon receiving comments from IDEM on the RI and FS reports and the Proposed Plan. IDEM supports the selection of Alternative 2.

Community Acceptance. This criterion evaluates the issues and concerns the public may have regarding the alternatives. This was addressed upon receiving comments documented during the public comment period. Residents in the community who support taking an action at the site prefer Alternative 2 over Alternative 3.

The full text of the detailed analysis of the three remedial alternatives against the nine evaluation criteria (including both the individual analysis and the comparative analysis) is contained in the FS report for the Jacobsville Neighborhood Soil Contamination site, which is part of the Administrative Record for the site. Because the two modifying criteria cannot be fully evaluated until the public comment is closed, they were not evaluated in the FS. The Responsiveness Summary of this ROD contains a more detailed discussion of public comments received.

Table 11. Comparative Analysis of Remedial Alternatives

Remedial Alternative Evaluation Summary

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Excavation, Backfill, and Site Restoration	Alternative 3: In Situ Treatment, Topsoil, and Site Restoration
Overall Protection to Human Health and the Environment			
Protection of human health and the environment	Not protective.	Protective.	Protective.
Compliance with ARARs			
Location-specific ARARs	Not in compliance.	In compliance.	In compliance.
Action-specific ARARs	Not in compliance.	In compliance.	In compliance.
Chemical-specific ARARs	Not in compliance.	In compliance.	In compliance.
Long-Term Effectiveness and Permanence			
Magnitude of residual risk	Residual risk remains.	No residual risk. [a]	Low residual risk.[a]
Adequacy and reliability of controls	No controls.	Very reliable.	Limited performance measures.
Need for 5-year review	Required.	Required.[b]	Required.[b]
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment processes used and materials treated	None.	None.	Treatment process utilized.
Amount of hazardous material destroyed or treated	None.	None.	50% treatment.
Expected reduction in toxicity, mobility, or volume of the waste	None.	None.	Toxicity and mobility reduced.
Irreversibility of treatment	Not applicable.	Not applicable.	Not likely irreversible.
Type and quantity of residuals that will remain following treatment	Not applicable.	Not applicable.	Some residuals.
Statutory preference for treatment	*Does not satisfy.*	*Does not satisfy.*	*Does satisfy.*
Short-Term Effectiveness			
Protection of workers during remedial action	Not applicable.	Moderate.	Moderate.
Protection of the community during remedial action	Not applicable.	Moderate.	Moderate.
Potential environmental impacts of remedial action	Not applicable.	Low.	Low.
Time until protection is achieved	Protection not achieved.	Immediate.	Immediate.

Table 11. Comparative Analysis of Remedial Alternatives

Remedial Alternative Evaluation Summary

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Excavation, Backfill, and Site Restoration	Alternative 3: In Situ Treatment, Topsoil, and Site Restoration
Implementability			
Technical feasibility	Not applicable.	Difficult.	Difficult.
Reliability of technology	Not applicable.	Very reliable.	Reliable.
Administrative feasibility	Not applicable.	Feasible.	Feasible.
Availability of services, equipment, and materials	Not applicable.	Readily available.	Readily available.
Cost			
Capital Cost	$0	$134,904,270	$156,287,268
Present Worth O&M	$0	$0	$1,494,324
Period of Analysis (years)	0	16	20
Capital and present worth O&M	$0	$134,904,270	$157,781,592

Note

[a]If access cannot be obtained at properties that have contamination above cleanup levels, these properties will still have residual risk.

[b]If access cannot be obtained at properties that have contamination above cleanup levels, five-year reviews will be required.

10.1 Overall Protection of Human Health and the Environment

Alternative 1, No Action, does not reduce potential risk to human health. Alternatives 2 and 3 are protective of human health and the environment. Alternative 2, Soil Excavation, Backfill, and Restoration, eliminates the potential risk to human health by removing contaminated soils in excess of the cleanup levels from the site. Alternative 3, In Situ Treatment and Site Restoration, eliminates or reduces the potential risk to human health and the environment by reducing the bioavailability of the contaminants within the soil.

10.2 Compliance with ARARs

Alternative 1 is not compliant with ARARs. Alternatives 2 and 3 will require significant effort during implementation to comply with local, state and federal ARARs related to waste characterization, transportation and disposal of contaminated material, stormwater/nuisance water, and fugitive particulate matter management during excavation activities.

10.3 Long-Term Effectiveness and Permanence

Alternative 1 does not achieve long-term effectiveness and permanence. Alternative 2 achieves long-term effectiveness and permanence by removing the contaminated soil and therefore permanently eliminates the exposure routes. The measurement of long-term effectiveness for Alternative 3 has not been determined because it is a relatively new technology. The technology is becoming more widely accepted, and treated sites have demonstrated success; however, it is too soon to have evidence that definitively demonstrates long-term effectiveness and permanence.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Neither Alternatives 1 nor 2 will reduce toxicity, mobility, or volume of the contaminants through treatment. Alternative 3 will reduce the toxicity and mobility of the contaminants through treatment of the soil.

10.5 Short-Term Effectiveness

Alternative 1 has no short-term effectiveness since no action will be taken. Alternatives 2 and 3 will affect residents, neighboring communities, and construction workers. A large number of trucks will be required to haul excavated materials offsite and/or import clean fill. Alternatives 2 and 3 will pose potential risks to residents and construction workers through airborne particles. Additional short-term risks associated with Alternatives 2 and 3 involve occupational construction risks and the potential of runoff infiltrating the stormwater drainage system. Engineering controls and other reasonable measures will be used to minimize these potential impacts.

10.6 Implementability

Alternative 1 is the easiest to implement because no effort is associated with the alternative. Alternative 2, Soil Excavation, Backfill, and Restoration, will be difficult to implement based on the excavation and disposal volume, clean fill volume, and amount of time required to move the large quantity of material. Working in and around residential properties will require hand digging in areas where earth moving equipment cannot reach, such as adjacent to structures. Implementation of Alternative 3 also will be difficult. Soil mixing will be a slow process, requiring hand digging in and around residences and structures. Site restoration will require a property-by-property determination for removal and disposal of excess soil to ensure proper drainage.

Although Alternative 2 employs a proven method, the in situ treatment of soils to be used in Alternative 3 is a relatively new technology, so Alternative 3 may present more challenges in its implementation.

10.7 Cost

In terms of net present worth, Alternative 1 has no cost. Alternative 2 has high costs associated with excavation, transportation, and disposal costs. Construction will require about 15 years to complete, resulting in high costs for construction oversight and management. Costs associated with Alternative 3 are also high. The cost of the reagents used for treatment is estimated at only $10 per treated ton, but the cost of the soil mixing will be high. There are also moderate costs associated with the transportation and placement of top soil and possible excavation and disposal of material during site restoration. Alternative 3 will also require about 20 years to complete and will incur high costs for oversight and management. Alternative 3 is the only alternative with associated O&M costs. A detailed cost breakdown for the preferred alternative, Alternative 2, is shown in Appendix E.

10.8 State Agency Acceptance

The state agency, IDEM, has been involved with the site prior to it being listed on the National Priorities List and was involved in all steps of the RI/FS for the site. The State of Indiana concurs with the selection of Alternative 2 for OU2 of the Jacobsville Neighborhood Soil Contamination site. The State of Indiana's concurrence letter is provided in Appendix B.

10.9 Community Acceptance

During the public comment period on the Proposed Plan, the community expressed some concerns about the proposed remedy for the Jacobsville Neighborhood Soil Contamination site. As discussed in the Responsiveness Summary, the local community is generally supportive of Alternative 2 and expressed that they want the remedy to be implemented as soon as possible. This ROD includes a Responsiveness Summary that summarizes the public comments and U.S. EPA's response to those comments. The Responsiveness Summary is included as Appendix A.

11.0 Principal Threat Wastes

The NCP establishes an expectation that U.S. EPA will use treatment to address the principal threat posed by a site wherever practicable. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The lead and arsenic contamination found in the soils at the Jacobsville Neighborhood Soil Contamination site are not considered to be highly toxic or highly mobile, and can be reliably contained. Therefore, the principal threat waste definition does not apply to the contamination at this site.

12.0 Selected Remedy

This section describes the selected remedy and provides U.S. EPA's reasoning behind its selection. Alternatives can change or be modified if new information is made available to U.S. EPA through further investigation or research. An appropriate range of alternatives was developed based upon initial screening of technologies, potential for contaminants to impact the environment, and site-specific RAOs and goals.

12.1 Identification of the Selected Remedy and Summary of the Rationale for its Selection

Based on the analysis of the nine criteria as summarized in Section 10 of this ROD, the selected remedy for the Jacobsville Neighborhood Soil Contamination site is Alternative 2. This alternative represents the best balance of overall protectiveness, compliance with ARARs, long-term effectiveness and permanence, cost, and other criteria.

Alternative 1, the No Action Alternative, is not acceptable because it does not provide adequate human health and environmental protection. Both Alternatives 2 and 3 meet the threshold criteria of protectiveness and compliance with ARARs. Alternative 2 provides more long-term protectiveness than Alternative 3 because the remedial technology is more tested and permanent. Alternative 2 is also less expensive than Alternative 3, thus making it a cost-effective remedial action. It is also the alternative favored by IDEM and the community.

12.2 Description of the Selected Remedy

Alternative 2 consists of excavating soil that contains arsenic and lead exceeding site cleanup levels from residential and high access properties, offsite disposal at a permitted Subtitle D landfill, backfilling with clean soil, and site restoration. This alternative assumes that the excavated soil will not be characterized as hazardous waste. This was confirmed by TCLP analyses performed on soils during the remedial design for OU1, where the more highly contaminated soils are expected. The excavation will be backfilled with clean fill and top soil and restored to original property condition. To ensure backfill material is clean, the borrow source vendor will need to test the soil and provide certification that the fill does not contain chemicals at levels that exceed residential screening levels.

The main components of Alternative 2 include the following:

- Through community outreach, property owners in OU2 will be contacted to gain access to their property to sample the soils (if necessary) and implement the remedy.

- Residential and high access soils within the OU2 boundaries will be sampled down to 18 inches to determine if they contain concentrations of arsenic and/or lead that are greater than the cleanup levels for the site.

- Completion of residential property checklists, taking inventory of vegetation, and collecting photographic documentation of current property conditions outside and potentially inside structures on the property;

- Clearing lots of shrubbery and debris;

- Residential and high access soils containing arsenic and/or lead at concentrations greater than the cleanup levels will have the soils excavated to the depth that the elevated concentrations were found, to a maximum of 18 inches. If physical barriers exist, such as trees, soil excavation will be done around the barrier to the extent possible. Engineering controls will be implemented in order to prevent exposure to lead and arsenic from dust created by the excavation of the soils. Building foundations, permanent walkways and fixtures will not be affected by the soil excavation.

- Collection of soil samples to verify that the soil is not characteristically hazardous for disposal purposes;

- Transportation and disposal of soil at an approved Subtitle D landfill; if possible, soil will be put to reuse, such as at industrial sites or as daily cover at a landfill;

- Once excavation is complete, clean fill will be placed in the excavated areas and the lawns will be returned to as close to their original condition as possible.

- For properties needing remediation but not granting access for sampling and/or cleanup and for properties which may have contamination above cleanup levels after excavation to 18 inches, institutional controls will be implemented consistent with local, state and federal government authority. It is anticipated that a lead hazard registry will be maintained that lists the remediation status of each property; and

- Whenever possible, cleanup priority will be given to those residents at higher risk, such as homes with children under 7 years of age. In addition, U.S. EPA will work with residents with special needs to ensure the cleanup can proceed without adversely affecting them.

Excavated soils will be transported to a RCRA Subtitle D landfill. Based on results of TCLP analyses for soils from OU1, this remedy assumes that the excavated soil will not be characterized as hazardous waste. Five-year reviews may be required for Alternative 2 if properties needing remediation cannot be accessed to perform the cleanup.

12.3 Summary of the Estimated Remedy Costs and Time Required for Implementation

The estimated cost of the selected remedy for the Jacobsville Neighborhood Soil Contamination site is $135,000,000. The remedial design is expected to take several years to complete, and the remedial action is expected to take about 15 years to complete. Appendix E contains the cost breakdown for Alternative 2.

The information in the cost estimate summary table is based on the best available information regarding the scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference (ESD), or a ROD Amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

12.4 Expected Outcomes of the Selected Remedy

The selected remedy for the Jacobsville Neighborhood Soil Contamination site, Alternative 2, will achieve the RAO for the site. The selected remedy will be protective of human health and the environment and will comply with all ARARs. The following are expected to occur by implementing Alternative 2 for OU2:

- All residential properties within OU2 will have lead and arsenic concentrations below the cleanup levels of 400 ppm and 30 ppm, respectively, down to 18 inches, which will reduce the potential human health risk within OU2 to acceptable levels as described in the NCP and U.S. EPA guidance.

- Blood lead levels of children in the area will decline due to decreased exposure to lead through the residential soils.

- There are anticipated beneficial socio-economic and community impacts resulting from the remediation of OU2. There are currently community organizations and not-for-profit developers interested in revitalization of the area. Many planned projects will be able to move forward once properties in the area are remediated.

Table 10 in Section 7.4 summarizes the cleanup levels for the Jacobsville Neighborhood Soil Contamination site that will achieve these expected outcomes.

13.0 Statutory Determinations

Under CERCLA Section 121 and the NCP, remedies selected for Superfund sites are required to be protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a waiver is justified) and be cost effective. The following sections discuss how the selected remedy for the Jacobsville Neighborhood Soil Contamination site meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The current and potential future risks at the Jacobsville Neighborhood Soil Contamination site are due to the presence of lead and arsenic in residential soils. Implementation of the selected remedy will be protective of human health and the environment, as described in the NCP, through the removal of residential soils with lead concentrations above 400 ppm and/or arsenic concentrations above 30 ppm. The site specific RAO was developed to protect current and future receptors that are potentially at risk from contaminants at the site. The selected remedy will meet the RAO. Institutional controls are not expected to be required at remediated properties in order to ensure that the remedy remains protective. If a property is determined to require remediation and the owner refuses to allow U.S. EPA access to the property for cleanup and for properties which may have contamination above cleanup levels after excavation to 18 inches, institutional controls will be required for the property and five-year reviews will be required for those properties at the site.

13.2 Compliance with ARARs

Section 121(d) of CERCLA requires that Superfund remedial actions meet ARARs. Appendix D provides all ARARs identified for this site which will be met under this ROD. In addition to ARARs, non-enforceable guidelines, criteria, and standards may be useful in designing the selected remedy. As described previously in Section 8.2 of this ROD, these guidelines, criteria, and standards are known as TBCs. The selected remedy will comply with the ARARs for the site.

13.3 Cost Effectiveness

U.S. EPA has determined that the selected remedy for the Jacobsville Neighborhood Soil Contamination site is cost effective and represents value for the money to be spent. A cost effective remedy in the Superfund program is one whose costs are proportional to its overall effectiveness. The overall effectiveness of the potential remedial alternatives for the site was evaluated in the FS by considering the following three criteria: long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness. The overall effectiveness was then compared to cost to determine whether an alternative is cost effective. Of the remedial alternatives evaluated for this site, Alternative 2 provided the highest degree of cost effectiveness.

13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment are practicable at this site. Although treatment technologies will not be utilized in this remedy, the selected remedy is the only remedy with proven long-term permanence and is more cost-effective than treatment technologies available. The selected remedy also permanently removes the contamination from the site, allowing for unlimited residential and recreational use, and avoids the statutory requirements of five-year reviews and monitoring that would be needed if the contamination was treated and left in place. This remedy is also more easily implemented because removal of soils is less labor intensive than in-situ mixing of soils at each property. The selected remedy is also favored by the state and local community. To the extent that the remedial alternatives are comparable with respect to short-term effectiveness and implementability, these criteria were not decisive factors in the selection process.

13.5 Preference for Treatment as a Principal Element

This remedy does not satisfy the preference for treatment as a principal element of the remedy for the following reasons: (1) the in-situ treatment technology that exists for arsenic and lead in soils has not been studied enough to prove its long-term effectiveness and permanence, (2) in-situ treatment technologies are less-cost effective than this remedy, (3) the chosen remedy is a permanent remedy which physically removes all soils having concentrations greater than the cleanup levels and is widely accepted by the community, and (4) no source materials consisting of principal threat wastes will be addressed within the scope of this action; therefore, treatment of wastes prior to disposal was not evaluated.

13.6 Five-Year Review Requirements

The NCP requires that the remedial action be reviewed no less often than every five years if the remedial action results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure. If all contaminated properties are cleaned up and no hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure at the completion of the remedial action, no statutory reviews will be required after the completion of the remedial action. However, if any properties that require cleanup are not remediated, five-year reviews will be required.

14.0 Documentation of Significant Changes

The Proposed Plan for Jacobsville Neighborhood Soil Contamination site was released for public comment on June 11, 2009, and the public comment period ran from June 11 through July 10, 2009. The Proposed Plan identified Alternative 2 (Soil Excavation, Backfill, and Site Restoration) as the preferred alternative for the site. U.S. EPA reviewed all written and verbal comments submitted during the comment period and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

APPENDIX A
Responsiveness Summary

APPENDIX A
Responsiveness Summary

RESPONSIVENESS SUMMARY
for the Jacobsville Neighborhood Soil Contamination Site

This Responsiveness Summary provides both a summary of the public comments U.S. EPA received regarding the Proposed Plan of the Jacobsville Neighborhood Soil Contamination site and U.S. EPA's responses to those comments. The Proposed Plan was released to the public on June 11, 2009, and the public comment period ran from June 11 through July 10, 2009. Indiana Department of Environmental Management provided support on the Proposed Plan. U.S. EPA held two public meetings regarding the Proposed Plan, one on June 23, 2009, and one on June 24, 2009, at the Evansville Public Library—Central Branch, in Evansville, Indiana. Indiana Department of Environmental Management (IDEM) participated in the public meetings, assisted in responding to questions, and provided support at the meetings.

U.S. EPA received written comments (via regular and electronic mail) and verbal comments (at the public meetings) during the public comment period. In total, U.S. EPA received comments from approximately 27 people. Copies of all the comments received during the public comment period (including the verbal comments which can be found in the transcript of the public meeting) are included in the Administrative Record for the site. U.S. EPA carefully considered all comments prior to selecting the final site remedy documented in the ROD.

Because some of the comments were lengthy, this Responsiveness Summary provides excerpts from the comments in come cases. The remainder of this Responsiveness Summary contains the comments U.S. EPA received and U.S. EPA's responses to those comments.

Oral Comments

- **Oral Comment 1, June 23rd public meeting**
  Commenter: Cheryl Hartman

I've lived up here for ten years. I want to thank you for taking the time to take lead and arsenic out of the soil for our children's benefit because I have seen things like that happen with children in schools. So thank you.

U.S. EPA appreciates the comment. Our objective is to protect the health of both children and adults and the environment. We believe implementing Alternative 2 will ensure this objective is met.

- **Oral Comment 2, June 23rd public meeting**
  Commenter: Shawn Ackman

I would like to say thank you as well as in the short-term affect, yes, it does seem long-term, but I have a ten month old daughter and in ten years your project will be done and this will affect her tremendously and I thank you for that.

U.S. EPA appreciates the comment. U.S. EPA will do whatever it can to speed up the progress of the cleanup. In the meantime, there are a number of things to do to protect your and your family's health. These include taking actions such as keeping hands clean, reducing soil dust in the house, reducing outdoor activities that stir up dust, taking special care when gardening, giving children a safe play area, and thoroughly washing home-grown vegetables.

- **Oral Comment 3, June 23rd public meeting**
  Commenter: Simon Leon

I thank you for coming so that we can learn more about this. I just wish this was a little bit faster because the first thing I did when we moved into our home was brought my granddaughters over. We put in new flowers and everything. Then a few months later I got your notification. You know, can we test? It's like, oh, great, what have we done. Now, you said you remove a foot and a half of soil. This lead has leaked down into the soil. What is the chance of the lead that's gone down coming back up and recontaminating that soil? Especially since we're in a fault area and things get moved around every now and then.

U.S. EPA appreciates the comment. U.S. EPA will do whatever it can to speed up the progress of the cleanup. In the meantime, there are a number of things to do to protect your and your family's health. These include taking actions such as keeping hands clean, reducing soil dust in the house, reducing outdoor activities that stir up dust, taking special care when gardening, giving children a safe play area, and thoroughly washing home-grown vegetables.

Regarding the concern about recontamination, the results of U.S. EPA investigations showed that the majority of the lead and arsenic above cleanup levels have been found 18 inches or less below ground surface. That indicates that by implementing Alternative 2 and removing up to 18 inches of soil, nearly all of the lead and arsenic will be removed and recontamination will not likely occur.

- **Oral Comment 4, June 23rd public meeting**
  Commenter: Beverly McDaniel

I want to thank you for coming and giving us information. I'm very glad that you're doing this because I have a son that has Asperger's and autism has been linked to lead. So I'm very glad you're doing this. Thank you.

U.S. EPA appreciates the comment. Our objective is to protect the health of both children and adults and the environment. We believe implementing Alternative 2 will ensure this objective is met.

- **Oral Comment 5, June 23rd public meeting**
  Commenter: Helen Deig

I appreciate the fact that you had a map showing us the different color codings. The red, the yellow and the green areas because that relieves my mind a lot at this point.

This commenter is referring to a map showing sample results in the OU2 area. As described in the public meetings, not all of the samples collected from OU2 contained lead and arsenic above cleanup levels. Based on the limited data collected thus far, U.S. EPA estimates that about 40 percent of the homes in OU2 will require remediation.

- **Oral Comment 6, June 23rd public meeting**
  Commenter: Wendy Bredhold, Councilwoman, 3rd Ward, Evansville, IN

I'm the councilwoman for the third ward of Evansville which includes Jacobsville. When I arrived here, Dave told me that these areas don't get cleaned up unless someone identifies. They don't go around looking for these areas in the country. Do we have our local health department to thank for identifying these areas and contributing to the cleanup? I'm thankful that those agencies discovered that this area needed to be expanded so that we're able to get this on the road and get the area cleaned up.

U.S. EPA appreciates the comment. IDEM was the agency that took the initiative to collect soil samples from the Jacobsville neighborhood, and U.S. EPA continued the sampling effort between 2004 and 2006 to determine the full extent of the expanded area. The Vanderburgh County Health Department has contributed a great deal also by helping to educate the public about the dangers of lead and providing free blood lead level testing. Also, the City of Evansville has been an important partner in supporting the decisions about the cleanup and the sampling efforts on which the decisions have been based.

- **Oral Comment 7, June 23rd public meeting**
  Commenter: Gary Morris

I'm in one of those areas unfortunately where, I guess, fortunately that were left out of this. My concern basically was the fact of a two-fold. One was the fact that the maps that you have on the internet and even here are very difficult to tell what homes are in the area, what homes are not in the area. I think a clearer map or at least a street map with the delineations laid out would help community members know whether or not they should be concerned. Even those homes that are near the areas that you have already pointed out as lead contaminated arsenic contaminated, obviously would want to have their yards tested. Even if you don't do it, they're going to want somebody to test it to make sure that their homes are safe. So I feel that maybe the maps could have been clearer as far as where everything is cut off at so that people can start figuring out what they need to do to make their situation safer or better for themselves. Be able to contact Vanderburgh Health Department. Contact the Department of Environmental Management. Contact you all. So the maps I felt were a little disconcerted.

U.S. EPA appreciates the feedback about the map and acknowledges that the map included in the Proposed Plan Fact Sheet mailing was difficult to read and to tell if your home was included in the area of OU2 especially if it was near a boundary. U.S. EPA will work with the City to develop a map showing street names that is easier to read. Also, U.S. EPA maintains a database of all the homes within OU2 and encourages residents to call the toll-free number (800-621-

8431, ext. 74685 or ext. 67478) so that we can check to see if your home lies within the boundaries.

Regarding the development of OU2 boundaries, the boundaries were based on extensive systematic grid sampling. Because U.S. EPA was very conservative when drawing the boundaries and because they were drawn to encompass a buffer zone of samples that did not exceed the cleanup levels for lead or arsenic, U.S. EPA is very confident that homes outside of the OU2 boundaries are not impacted by site-related contamination. U.S. EPA will only be testing those yards within the OU2 boundaries.

- **Oral Comment 8, June 24th public meeting**
  Commenter: Audience member

One of the things that I've been curious about since I first started reading about this, which I think was in middle of the 1990's, I think the woman's problem back here. She moved into an area getting out of a problem. She bought into a problem. Then another gentleman made the comment about, you know, we don't live in a police state. I'm happy that that's the case so far. I'm curious as to why we haven't done more to keep kids from moving into this first area at least. It seems like there's more and more lead poisoning that's going on that could have been avoided by just simply making sure that kids weren't moving into that neighborhood.

Although U.S. EPA cannot control individuals' decisions to rent or own a home in a particular area, it can try to educate the public about areas of contamination and results of studies it has done. U.S. EPA will continue to distribute information regularly about the site to try to make sure the public is well-informed when they make their decisions about where to live. Even if you live within the OU1 or OU2 boundaries, however, there are steps you can take to minimize your exposure to lead and arsenic. These steps include as keeping hands clean, reducing soil dust in the house, reducing outdoor activities that stir up dust, taking special care when gardening, giving children a safe play area, and thoroughly washing home-grown vegetables.

- **Oral Comment 9, June 24th public meeting**
  Commenter: Audience member

Most of the comments you hear from people not signing the access agreements and sending them back is, they're going to come in here and disturb and they're not going to put it back like it was. Somehow, some way I'm going to get billed for this. That's what I hear more than anything.

U.S. EPA plans to make all reasonable efforts to ensure each property is returned to as close to its original condition as possible. Homeowners will have one year from the date of planting to request a second or third replacement of any trees or bushes that were replaced. All fences and other features such as swings and benches will be returned to their original locations. Watering will be done for six weeks after grass is seeded to ensure it has time to take root. Regarding the question of the cost of the cleanup, the federal and state government will be paying for all costs. The homeowner will not be charged for the cleanup and will not receive any bills for it.

Written Comments

- Commenter 1: Kenneth Gish

I have lived at [my property] continually since 1985. I lived there also when I was a small boy between 1953–1973. I am not interested in any soil sampling or anything else on my property. As long as I have lived here, I have not experienced any physical problems that could be traced to soil contamination. I am 59 years old and have no children. It's only my cat and myself. Please bother other people concerning this matter.

Arsenic is a carcinogen, and lead adversely affects the central nervous system. Due to the possible health effects from lead and arsenic and results of studies of the expanded Jacobsville site, U.S. EPA believes it is necessary to take action to protect human health and the environment. Although individuals have different tolerances to toxins, because arsenic and lead do not readily degrade, U.S. EPA's actions are also being done for future generations who might live in the area.

The Center for Disease Control (CDC) notes the following effects due to exposure to high levels of lead:

- *Lead can produce adverse effects on virtually every system in the body; it can damage the kidneys, the nervous system, the reproductive system, and cause high blood pressure. It is especially harmful to the developing brains of fetuses and young children.*

- *There may be no lower threshold for some of the adverse effects of lead in children. In addition, the harm that lead causes to children increases as their blood lead levels increase. Blood lead levels as low as 10 µg/dL are associated with harmful effects on children's learning and behavior.*

- *Very high blood lead levels cause devastating health consequences including seizures, coma, and death.*

- *Children with venous blood lead levels of 20 µg/dL or above or with venous blood lead levels in the range of 15-19 µg/dL over a period of at least 3 months need a doctor's care.*

- *Elevated blood lead levels in children are a major preventable health problem that affects children's mental and physical health. The higher a child's BLL and the longer it persists, the greater the chance that the child will be affected. Elevated blood lead levels can result in:*

    - *learning disabilities*
    - *behavioral problems*
    - *mental retardation*
    - *at extremely high levels (70 µg/dL or higher), seizures, coma, and even death*

- Commenter 2: Matt Treado

I am in favor of a clean-up project that will not require any additional treatment or the use of any chemicals that could require potential treatment in the future. After reading through the literature provided, I feel soil replacement would satisfy these criteria.

However, I am worried about where the contaminated soil would end up and what that would mean for my home during the process. How long would the process take start-to-finish? How will my life be disrupted? Fencing structures? And what kind of insurance will be given that existing structures will no be harmed?

I look forward to hearing future discussions on this very important issue and do believe it is a worthy cause that demands immediate attention.

U.S. EPA appreciates the support for the proposed remedy. U.S. EPA will be holding a number of public meetings and sending out informational mailings prior to the start of cleanup, so residents will learn more details as the time to start the cleanup approaches. The contaminated soil will be transported to a licensed approved landfill for safe disposal. All new fill being brought in to backfill excavated properties will be carefully tested to ensure that it is safe. The remediation process will take approximately 15 years to complete, but the cleanup of each individual property will take only 10 days or less from start to finish. Full restoration of grass and replacement of bushes may take longer than that. Residents will not be asked to move out of their homes while cleanup is taking place, but U.S. EPA may ask them to only use the front or back doors for several days. Fences will only be removed temporarily if necessary to allow earth-moving equipment to perform the excavation. To prevent damage to structures, U.S. EPA will stay one foot away from all foundations and will manually dig around structures such as porches to ensure no damage occurs.

- Commenter 3: Carolyn Mueller

I am in favor of Option 2 of the cleanup plan for the Jacobsville Soil Contamination Site. This option would take somewhat less time-which, I think is certainly a concern.

U.S. EPA appreciates the support for the proposed remedy.

- Commenter 4: Paula Chika

I would highly recommend EPA act quickly. There are a lot of kids in these zones. Unfortunately, they are the most vulnerable as they are lower class. I have 4 grandchildren they live in zone OU2 north and I live in OU2 South. I do not know if our yards have been tested, but it seems they have been put at risk or is at risk. My grandchildren range in ages from 11 weeks to 6 years of age. The 2 oldest, loves to play outdoors. Since getting this information, there have been limited or have stopped playing outside. I highly recommend option 2 as EPA recommends. Please do not let there be another decade before action is taken and more lives are put at risk.

U.S. EPA appreciates the support for the proposed remedy. Because of the effect that lead can have on a child's developing nervous system, like the commenter, U.S. EPA is concerned about the risk to children, especially those under the age of 7. U.S. EPA will do whatever it can to speed up the progress of the cleanup. In the meantime, there are a number of things to do to protect your and your family's health. These include taking actions such as keeping hands clean, reducing soil dust in the house, reducing outdoor activities that stir up dust, taking special care when gardening, giving children a safe play area, and thoroughly washing home-grown vegetables. The cleanup will take over ten years to complete, so taking these actions to minimize your and your children's exposure to lead and arsenic is very important.

- Commenter 5: Angela Higgins

Will it consist of Union Workers? How long will it last? What actually happens? Will we have to relocate? How long will it take?

U.S. EPA will be holding a number of public meetings and sending out informational mailings prior to the start of cleanup, so residents will learn more details as the time to start the cleanup approaches. The full OU2 remediation process will take approximately 15 years to complete, but the cleanup of each individual property will take only 10 days or less from start to finish of excavation. Full restoration of grass and replacement of bushes may take longer than that. Residents will not be asked to move out of their homes while cleanup is taking place, but U.S. EPA may ask them to only use the front or back doors for several days. U.S. EPA contractors will conduct a fair and objective bidding process when hiring the subcontractors who will be doing the work, and the subcontracting firms may or may not consist of Union workers.

- Commenter 6: Tom Woods

I believe no action should be taken with regards to the lead clean up in the Culver neighborhood area, located in the designated OU2 South sight, especially on a street where no children reside. I feel the benefits do not out weigh the risks environmentally in this area.

U.S. EPA appreciates this different opinion. Because U.S. EPA's mission is to protect human health and the environment, it takes a conservative approach when making decisions about what actions to take when a contaminated area is identified. Although individuals have different tolerances to toxins, because arsenic and lead do not readily degrade, U.S. EPA's actions are also being done to protect future generations who might live in the area. Arsenic is a carcinogen, and lead can produce adverse effects on virtually every system in the body. Lead can damage the kidneys, the nervous system, the reproductive system, and cause high blood pressure, and it is especially harmful to the developing brains of fetuses and young children. See the response to Commenter 1 above for further information about the potential health effects of lead.

- Commenters 7: Marlene Reed, Pamela Mordecai, and Marilyn Blahovec

I'm not sure if this address is included in the clean-up area, but if it is we are all for it. Preferably option #2.

U.S. EPA appreciates the support for the proposed remedy.

- Commenter 8: Ellis Family

In reading the information on EVALUATION OF CLEANUP OPTIONS I would have to say that OPTION 2 seems to the best way to go. If or when the time comes to do the work, you would definitely have our permission for all the accessibility that will be needed.

U.S. EPA appreciates the support for the proposed remedy and the willingness to allow access so that the cleanup can proceed.

- Commenter 9: Dorothy Lantrip

Around the time period of Sept. 2005, my soil at [my property] was tested and come back clean. I can't recall who it was that asked my permission to test and why they wished to do so.

Due to this fact and that it came back clean; I opt for option 1- No Action. Mrs. Vivian Balloia was living in said property at the time of testing and was aware it was clean also. I feel it might just be the cities way to scam us property owners so restrictions on property and a notice on our deed might force us to take less money for the sale of our property for the "Industrial Park Project" that fell through. Then someone else can profit form our loss.

U.S. EPA decisions are based solely on its mission to protect human health and the environment. For all properties that show no exceedences of the lead or arsenic cleanup levels, no action will need to be taken and no restrictions on the property will be necessary. For all properties that do show exceedences of the lead or arsenic cleanup levels, U.S. EPA will conduct and pay for the cleanup and no restrictions on the property will be necessary. Restrictions on the property will only be necessary if exceedences of lead or arsenic are identified and U.S. EPA is refused access to the property.

- Commenter 10: Veronica Steinkuhl

I say option #1 – No further clean up suspicious homes located within a 1 or 2 block radius of an industrial environment building.

I do want to comment on a well-done job of the Jacobsville area already done. Also, if you should decide to replace soil, as stated in option #2 and #3, how can you be sure the newly replaced soil is not contaminated in some other way?

I vote leave all homes alone except suspicious ones as I stated above.

U.S. EPA appreciates the comment on the quality of the work in the Jacobsville neighborhood so far. When U.S. EPA replaces soil on a property, all new fill being brought in to backfill the excavations will be carefully tested to ensure that it is safe. Systematic grid sampling performed by U.S. EPA showed that the lead and arsenic contamination extended beyond the original OU1 area, so actions will be needed to address the contaminated soil in the expanded OU2 area. Soil from a property will only require remediation if sampling results show that concentration of arsenic or lead exceed cleanup levels. If soil sampling results show that arsenic and lead are below cleanup levels, the property will not need to be remediated.

- Commenter 11: Garland Johnson

What are you going to remove to clean up houses soil or remove of substances cause health problems and is EPA going to pay for every ones homes and land. I live in OU2 South group.

Note: Are they going to remove soil and homes that are bad and replace them? Are they going to make you just move out? Are they going to pay you or removed to restore that land?

If sampling results show that concentration of arsenic or lead exceeds cleanup levels, the property will be remediated. However, if soil sampling results show that arsenic and lead are below cleanup levels, the property will not need to be cleaned up. U.S. EPA and IDEM will be paying for the cleanup but will not be purchasing any residences or land. Residents will not be asked to move out during the cleanup.

- Commenter 12: Jim Lang

As I read the map, we are in "OU2". One property has no yard (soil exposed). It is covered by building, concrete and asphalt. The other property only has a small front yard and very small yards on West and South. The rest of this property is covered by building, concrete and asphalt.

I have no problems with soil being removed and replaced with new soil, sooner the better!!

U.S. EPA appreciates the support for the proposed remedy and the willingness to allow access so that the cleanup can proceed. No excavations from beneath buildings, sidewalks or other permanent structures will take place. However, yards will be excavated if exceedences of cleanup levels are identified regardless of the size of the yard.

- Commenter 13: David Hanes

The EPA has hound a high level of lead in one of my neighbor's yard on the 600 block of N. 2nd Ave. That's right across from my house on N. 3rd Ave. My house was built in 1869 so it's bound to have lead in the ground.

All homes with the OU2 boundaries will be tested for lead and arsenic. If exceedences of the cleanup levels are observed, the property will be cleaned up. Because of the nature of how the contamination was spread (airborne deposition) and the amount of regrading and soil movement that has taken place since the facilities that were the sources of the contamination were shut *down in the 1950s, however, the pattern of contamination is not completely predictable. So even if a neighboring yard shows exceedences of lead and arsenic cleanup levels, your yard or the yard next door may not. That is why we'll be relying on results of sampling of each yard to determine if cleanup is needed.*

- Commenters 14: Janet McCormick and Nick Crawley

Thank you for helping our neighborhood. Option #2 is what we prefer. It looks the safest and most cost effective.

U.S. EPA appreciates the support for the proposed remedy.

- Commenter 15: Rob Hutchinson

I lean towards option 2; however I oppose any increase in property tax. Especially for rental houses. Keep in mind a lot of these houses are rentals. Now is not the time to increase taxes! Use the money currently being paid in to fund the cleanup. People are barely affording housing now, raising taxes is not the answer. Use existing government workers for this cleanup rather than hiring new. Tell them to quit holding up the end of their shovels and to get over here and get to work. I am sick of government that works half as hard as I do. Let's fire half the people in the city gov. building and give them a shovel. That would solve the problem.

U.S. EPA appreciates the support for the proposed remedy. U.S. EPA and IDEM will be covering the entire cost of the remediation using money budgeted for these types of cleanups. U.S. EPA is not aware of any plans to increase property taxes due to the cleanup.

- Commenter 16: Catherine Engel

This is an extensive project and I hope that they [EPA] will receive all the cooperation from owners and others as needed to complete this important cleanup. I did ask a question concerning if a property owner wanted to do some renovations to his/her home, are there any regulations, to which the answer was just be careful but there are no regulations to restrict any remodeling. However, as I was thinking more about this, if the renovation (for example, an addition with a basement) required removal of dirt that has been tested and is known to be contaminated, shouldn't there be some restriction in place to make sure that there is proper disposal of the soil if it is to be removed from the property pre-cleanup date? The EPA is going to great expense to make sure contamination is limited and is cleaned-up, surely there should be a regulation on how contaminated soil is managed without limiting property owners' rights to make improvements to their property...In my opinion, it should be an EPA requirement not something that each local community who is in the same situation would necessarily have to have in its own ordinance.

If U.S. EPA has tested the soil and determined it requires excavation under the Superfund program to protect human health and the environment, the homeowner should contact the U.S. EPA Remedial Project Manager prior to digging in the soil. U.S. EPA will want to make sure that any work performed will not release pollutants or contaminants into the environment. In *such a situation, it would probably be best to postpone any remodeling work until U.S. EPA completes the removal of the contaminated soil.*

APPENDIX B
Concurrence Letter from State of Indiana

IDEM

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We Protect Hoosiers and Our Environment.

Mitchell E. Daniels, Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

September 10, 2009

Mr. Richard C. Karl, Director
Superfund Division (S-6J)
U.S. EPA, Region V
77 West Jackson Blvd.
Chicago, Illinois 60604-3507

Dear Mr. Karl:

Re: Record of Decision, Operable Unit 2
Jacobsville Neighborhood Soil
Contamination Superfund Site
Evansville, Indiana

The Indiana Department of Environmental Management (IDEM) provides this revised concurrence letter to replace the previously issued letter to correct errors and adjusted language in the Record of Decision identified by U.S. Environmental Protection Agency (U.S. EPA) staff. The revised concurrence letter is in response to the U.S. EPA's Proposed Plan and Record of Decision (ROD) for Operable Unit 2 (OU2) of the Jacobsville Neighborhood Soil Contamination (JNSC) Superfund Site. IDEM concurs with the major components of the selected remedy, Alternative 2, as outlined in the document and include:

- Gaining access to residential properties.
- Sampling residential yards that were not sampled during previous sampling events to a depth of 18-inches below ground surface to determine the need and the extent, including depth, for remedial actions at each property.
- Collecting soil samples from residential lots to verify that the soil is not characteristically hazardous for disposal purposes.
- Completing residential property checklists, completing an inventory of current vegetation, and collecting photographic documentation of current property conditions outside and potentially inside structures on the property.
- If physical barriers exist, such as large trees, soil will be excavated around the barrier to the extent possible.
- Engineering controls will be implemented in order to prevent exposure to lead and arsenic from dust created by the excavation of the soils.
- Building foundations, permanent walkways and fixtures will not be affected by the soil excavation.
- Residential soils containing concentrations greater than the arsenic and/or lead remediation goals will have the soils excavated to the depth that the elevated concentrations were found, up to 18-inches.

- Excavated soils will be transported to a RCRA Subtitle D landfill. This remedy assumes that the excavated soil will not be characterized as hazardous waste.
- Backfilling excavation with clean general fill and topsoil.
- Restoring the property to as close to original conditions as possible.
- Implementation of Institutional Controls (ICs) at properties where lead and arsenic have been identified above cleanup levels but for which access to conduct the cleanup cannot be gained. These ICs may consist of a lead hazard registry listing the status of each property or other types of ICs, as appropriate.

IDEM staff agree that the selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. IDEM staff have been working closely with U.S. EPA Region V staff in the selection of an appropriate remedy and is satisfied with the selected alternative.

The ROD also indicates that for properties that do not grant access for sampling and/or cleanup, ICs will be implemented consistent with local, state and federal government authority. However, State of Indiana statute does not allow for placement of property restrictions without confirmation of contamination; therefore, IDEM staff encourage U.S. EPA staff to exhaust all regulatory means to assure complete participation by all property owners within the site boundary.

Please be assured that IDEM is committed to accomplishing remediation at all Indiana sites on the National Priorities List and intends to fulfill all obligations required by law to achieve that goal. It is the understanding of IDEM staff that EPA has indicated that the remedial action (RA) phase for OU2 will not commence until the OU1 remedial action is complete. We look forward to beginning work on this project at that time.

Sincerely,

Bruce H Palin

Bruce H Palin
Assistant Commissioner
Office of Land Quality

BP:KH:bl
cc: Peggy Dorsey, IDEM
Bruce Oertel, IDEM
Rex Osborn, IDEM
Dave Holder, IDEM
Kevin Herron, IDEM
Mary Tierney, EPA

APPENDIX C
Administrative Record Index

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, VANDERBURGH COUNTY, INDIANA

ORIGINAL
APRIL 28, 2005

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	01/13/05	Sleboda, J., U.S. EPA	U.S. EPA	Technical Memorandum #1: Field Sampling Report for Sampling Event (November 29-December 3, 2004)	28
2	04/04/05	Sleboda, J., U.S. EPA	U.S. EPA	Technical Memorandum #2: Preliminary Site Characterization Summary for Sampling Event (November 29-December 3, 2004)	31

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, VANDERBURGH COUNTY, INDIANA

UPDATE #1
DECEMBER 21, 2006

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	12/07/04	Sleboda, J., U.S. EPA	U.S. EPA	Quality Assurance Project Plan for the Jacobsville Neighborhood Soil Contamination Site Revision 1	150
2	07/11/05	Sleboda, J., U.S. EPA	U.S. EPA	Technical Memorandum #4: Preliminary Site Characterization Summary for Dates: April 11-15, 2005 Revision 0	68
3	08/18/05	Sleboda, J., U.S. EPA	U.S. EPA	Technical Memorandum #3: Field Summary Report for Sampling Event Dates: April 11-15, 2005 for the Jacobsville Neighborhood Soil Contamination Site - Revision 1	31
4	12/28/05	Sleboda, J., U.S. EPA	U.S. EPA	Technical Memorandum #5: Field Summary Report for Sampling Event Dates: October 17-26, 2005 Revision 0	67
5	01/23/06	CH2M HILL	U.S. EPA	Signature Page for the Final Quality Assurance Project Plan for the Jacobsville Neighborhood Soil Contamination Site	1
6	01/23/06	Sleboda, J., U.S. EPA	U.S. EPA	Technical Memorandum #6: Preliminary Site Characterization Summary for Dates: October 17-27, 2005 Revision 0	56
7	01/23/06	Chapman, T., CH2M HILL	Sleboda, J., U.S. EPA	Site Specific Plans for the Jacobsville Neighborhood Soil Contamination Site w/Cover Letter	477
8	09/00/06	CH2M HILL	U.S. EPA	Final Remedial Investigation Report for the Jacobsville Neighborhood Soil Contamination Site	627

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, VANDERBURGH COUNTY, INDIANA

UPDATE #2
JANUARY 12, 2007

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	01/00/07	CH2M Hill	U.S. EPA	Feasibility Study Report for the Jacobsville Neighborhood Soil Contamination Site	47

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, VANDERBURGH COUNTY, INDIANA

UPDATE #3
AUGUST 22, 2007

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	01/00/07	U.S. EPA	Public	Proposed Plan for the Jacobsville Neighborhood Soil Contamination Site	8
2	08/22/07	Turner, K., U.S. EPA	Karl, R., U.S. EPA	Action Memorandum: Request for a Time Critical Removal Action at the Jacobsville Neighborhood Soil Contamination Site (PORTIONS OF THIS DOCUMENT HAVE BEEN REDACTED)	17

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, VANDERBURGH COUNTY, INDIANA

UPDATE #4
FEBRUARY 14, 2008

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	01/23/07	Lenn, S., Tri-State Reporting, Inc.	U.S. EPA/ Public	Public Hearing Transcript: Proposed Plan for the Jacobsville Neighborhood Soil Contamination Site	67
2	02/08/07	Strijek, C., Kentuckiana Reporters	U.S. EPA/ Public	Public Meeting Transcript: Proposed Plan for Soil Cleanup at the Jacobsville Neighborhood Soil Contamination Site - Afternoon Session	27
3	02/08/07	Strijek, C., Kentuckiana Reporters	U.S. EPA/ Public	Public Meeting Transcript: Proposed Plan for Soil Cleanup at the Jacobsville Neighborhood Soil Contamination Site - Evening Session	60
4	12/13/07	CH2M HILL	U.S. EPA	Technical Memorandum: Revised Remediation Cost Estimate, Jacobsville Neighborhood Soil Contamination Site	4
5	01/00/08	CH2M HILL	U.S. EPA	Bioavailability Study Report for the Jacobsville Neighborhood Soil Contamination Site	73
6	02/14/08	Karl, R., U.S. EPA	U.S. EPA/ Public	Record of Decision for the Jacobsville Neighborhood Soil Contamination Site	95

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, INDIANA

UPDATE #5
JUNE 5, 2009

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	10/00/07	CH2M Hill	U.S. EPA	Site Specific Plans Addendum **(SDMS ID: 311765)**	170
2	06/27/08	CH2M Hill	U.S. EPA	Final Feasibility Study Report for Operable Unit 2 **(SDMS ID: 311766)**	59
3	07/00/08	CH2M Hill	U.S. EPA	Addendum to Site Specific Plans for Operable Unit 1 **(SDMS ID: 311764)**	286
4	01/00/09	CH2M Hill	U.S. EPA	Revised Cost Estimates for Alternatives 2 and 3 **(SDMS ID: 311761)**	8
5	03/00/09	CH2M Hill	U.S. EPA	Final Data Evaluation Report for 2008 Remedial Design Sampling Event **(SDMS ID: 311767)**	125
6	04/00/09	CH2M Hill	U.S. EPA	Revised Final Remedial Design for Operable Unit 1 **(SDMS ID: 311763)**	327
7	05/00/09	U.S. EPA	File	Technical Memorandum: EPA Sampling Events December 2004, April 2005, October 2005 and October 2006 **(SDMS ID: 311762)**	22
8	00/00/00	U.S. EPA	Public	Proposed Plan for Operable Unit 2 **(PENDING)**	
9	00/00/00	U.S. EPA	Public	Record of Decision for Operable Unit 2 **(PENDING)**	

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR
JACOBSVILLE NEIGHBORHOOD SOIL CONTAMINATION SITE
EVANSVILLE, INDIANA

UPDATE #6
SEPTEMBER 9, 2009

NO.	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	06/23/09	Jensen Reporting	U.S. EPA	Transcript: Jacobsville Neighborhood Soil Contamination Public Hearing	
2	06/24/09	Jensen Reporting	U.S. EPA	Transcript: Jacobsville Neighborhood Soil Contamination Public Hearing	
3	07/07/09	Concerned Citizens	Novak, D., U.S. EPA	Public Comment Sheets re: the Proposed Cleanup Plan for the Jacobsville Neighborhood Soil Contamination Site **(PORTIONS OF THIS DOCUMENT HAVE BEEN REDACTED)**	
4	08/14/09	CH2M Hill	Tierney, M., U.S. EPA	Memorandum re: Summary of Historical Data for the Jacobsville Neighborhood Soil Contamination Site	

APPENDIX D
ARARs and TBCs

Requirement	Requirement Synopsis
Location-Specific ARARs	
Federal	
Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)	The Act provides protection and consultation with the U.S. Fish and Wildlife Service and state counterpart for actions that would affect streams, wetlands, other water bodies, or protected habitats. Action taken should protect fish or wildlife, and measures should be developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife. This Act is considered an ARAR for site contaminants and any future remediation construction activities that may affect surface waters and streams.
Action-Specific ARARs	
Federal	
Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.)	The Act provides regulations governing the transportation of hazardous materials and hazardous waste. The regulations include recordkeeping and reporting requirements; labeling and packaging requirements; and detailed handling requirements for each mode of transport (rail, air, waterway, or road). Remedial alternatives involving transport of hazardous materials are not anticipated. Contaminated soils or wastes that are excavated for offsite disposal would, however, be tested for hazardous waste characteristics, and if soil or waste is found to be hazardous waste, the requirements of this act would be followed. Soils are required to be managed as a hazardous waste if they contain listed hazardous waste or have the characteristics of a hazardous waste.
Resource Conservation and Recovery Act (42 U.S.C. 321 et seq.)	RCRA was passed in 1976. It amended the Solid Waste Disposal Act by including provisions for hazardous waste management. The goals of RCRA are to promote conservation of natural resources while protecting human health and the environment. The statute sets out to control the management of hazardous waste from inception to ultimate disposal. RCRA is also linked closely with CERCLA, and the CERCLA list of hazardous substances includes RCRA hazardous wastes. The Act applies to remedies that generate hazardous waste. Soils are required to be managed as hazardous waste if they contain listed hazardous waste or have the characteristics of hazardous waste. The Act may apply and will be adhered to if future remedies generate waste that can be classified as hazardous.
Occupational Safety and Heath Act (29 U.S.C. 61 et seq.)	The Act was passed in 1970 to ensure worker safety on the job. The U.S Department of Labor oversees it. Worker safety at hazardous waste sites is addressed under 29 CFR 1910. 120: Hazardous Waste Operations and Emergency Response. General worker safety is covered elsewhere within the law. The Act is considered an ARAR for construction activities performed during the implementation of remedies.

Clean Air Act (42 U.S.C. 7401 et seq.)	The Act is intended to protect the quality of air and promote public health. Title I of the Act directed the USEPA to publish national ambient air quality standards for "criteria pollutants." In addition, USEPA has provided national emission standards for hazardous air pollutants under Title III of the Act. Hazardous air pollutants are also designated hazardous substances under CERCLA. The Clean Air Act amendments of 1990 greatly expanded the role of National Emission Standards for Hazardous Air Pollutants by designating 179 new hazardous air pollutants and directed USEPA to attain maximum achievable control technology standards for emission sources. Such emission standards are potential ARARs if selected remedial technologies produce air emissions of regulated hazardous air pollutants. The Act is considered an ARAR for remedies that involve creation of air emissions, such as excavation activities that might create dust.
State	
Indiana Solid Waste Rules (IAC Title 329)	This law applies to remedies that involve offsite disposal of materials typically involved with excavations. Contaminated soils or wastes that are excavated for offsite disposal would be tested for hazardous waste characteristics and, if soil or waste is found to be hazardous waste, the requirements of the Rules would be followed.
Indiana Air Pollution Control Regulations (IAC Title 326)	The law is considered an ARAR for remedies that involve creation of air emissions, such as excavation activities that have the potential to create dust.
Chemical-Specific ARARs	
Federal	
Clean Water Act (33 U.S.C. 1251 et seq.)	The Act was passed in 1977. It is a major amendment of the original 1972 Federal Water Pollution Control Act. Its chief purpose is to restore and maintain surface water quality by controlling discharges of chemicals (priority toxic pollutants) to surface water. The act is closely linked to CERCLA: all 126 priority toxic pollutants under the act are CERCLA hazardous substances. Direct and indirect discharges of priority pollutants to surface water are regulated through NPDES. The NPDES program also includes ambient water quality standards and antidegradation policy standards. The Act is considered an ARAR for remedies involving construction activities that have the potential to affect surface water, such as excavation or that involve discharge of groundwater to surface water.
State (To be Considered)	
Voluntary Remediation of Hazardous Substances and Petroleum (IC 13-25-5)	IC 13-25-5 established the Voluntary Remediation Program in 1993 and gave the IDEM the authority to establish guidelines for voluntary site closure. Under this authority IDEM developed a nonrule policy document, the Risk Integrated System of Closure to guide site closures within the authority of IDEM's remediation programs. This guidance document does not have the effect of law.
Contained-in Policy Guidance for RCRA	Guidance document on management of remediation waste. This guidance document does not have the effect of law.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

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Mitchell E. Daniels, Jr
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
(800) 451-6027
www.idem.IN.gov

January 25, 2007

Ms. Jena Sleboda
Remedial Project Manager
U.S. EPA Region 5, Superfund Division
Mail Code: SR-6J
77 West Jackson Blvd.
Chicago, Illinois 60604

Dear Ms. Sleboda:

Re: Applicable or Relevant and Appropriate Requirements for Jacobsville Neighborhood Soil Contamination Superfund Site, Evansville, Vanderburgh County, Indiana

Indiana Department of Environmental Management staff have performed an evaluation to determinate the Applicable or Relevant and Appropriate Requirements (ARARs) for the Jacobsville Neighborhood Soil Contamination (JNSC) Superfund Site in Evansville, Vanderburgh County, Indiana. The ARARs determination was evaluated for the three proposed remedial alternatives, which include Alternative 1 - No Action, Alternative 2 – Soil Excavation, Backfill and Site Restoration, and Alternative 3 – In Situ Treatment and Site Restoration. The proposed remedial alternatives are subject to the Indiana Administrative Code (IAC) and Indiana Code (IC) as follows:

1. Chemical-Specific Requirements:

    a. 326 IAC 2 regulates any source which has the potential to emit air pollutants. Since the JNSC site is a National Priorities List (NPL) site, registration and a permit may not be required. The facility will, however, need to comply with the substantive requirements of registration and a permit.

    b. 329 IAC 3.1 establishes a hazardous waste management program consistent with the requirements of the Resource Conservation and Recovery Act (RCRA). All wastes generated by remediation activities must undergo a waste determination. All wastes determined to be hazardous must be disposed in an approved RCRA permitted facility in accordance with 40 CFR 260-280.

    c. 329 IAC 10 regulates the management of solid wastes. All waste determined to be nonhazardous must be disposed in a facility permitted to accept such waste.

2. Action-Specific Requirements:

   a. Hazardous Air Pollutants (HAPs) are defined at 326 IAC 1-2-33.5 as any air pollutant listed pursuant to Section 112(b) of the Clean Air Act. HAPs are regulated because of their toxic effects. HAPs are regulated by 326 IAC 2. This site is contaminated with lead and possibly arsenic. Compounds of arsenic and lead emitted into the air are HAPs.

      - 326 IAC 2-5.1-2(a)(1)(A) requires a source that has the potential to emit five (5) tons per year of particulate matter (PM) to apply for a registration. A source with lower emissions is exempt.
      - 326 IAC 2-5.1-2(a)(1)(F) requires a source that has the potential to emit two-tenths (0.2) ton per year of lead to apply for a registration. A source with lower emissions is exempt.

      The report evaluating the three remedial alternatives gives no measurement or estimate of the amount of contaminates that may be emitted to the air as a result of the remedial actions. Therefore, the potential air pollution emissions resulting from the remedial actions cannot be calculated.

   b. Fugitive dust, defined as dust that crosses onto a property line, is defined and regulated by 326 IAC 6-4-1. This includes the generation of particulate matter to the extent that some portion of the material escapes beyond the property line or boundaries of the property, right of way, or easement on which the source is located. Fugitive dust and particulate matter releases may occur when soil is disturbed during remediation, including excavation of contaminated soils, transportation of soil, and backfilling. Particulate matter is defined at 326 IAC 1-2-52 and regulated by 326 IAC 2 and 326 IAC 6.

   c. 326 IAC 6-4-4 requires that any vehicle driven on any public right of way must not allow its contents to escape and form fugitive dust. This rule applies to any soil movement or removal actions.

   d. 329 IAC 3.1 (http://www.in.gov/legislative/iac/T03290/A00031.PDF) establishes a hazardous waste management program consistent with the requirements of RCRA.

   e. Requirements for solid waste land disposal facilities can be found in 329 IAC 10.

   f. The possibility of impact on surface water would be minimal because there is no proven surface water migration pathway (www.epa.gov/supefund/sites/docrec/pdoc1711.pdf). However, if a discharge to surface water is anticipated, 327 IAC 2-1-1.5 and 2-1-6, should be followed.

   g. Additional information needs to be provided to the Indiana Department of Natural Resources (IDNR) Division of Historical Preservation in order for them to conduct a complete analysis of the proposed remedies. IDEM staff provided the IDNR Division of Historic Preservation staff a hard copy of the draft FS Report. A copy of their January 4, 2007, letter is enclosed. The IDNR, Divisions of Water or Fish and Wildlife, has no ARARs for the JNSC Superfund Site.

3. There are no Location-Specific Requirements at this time.

4. To Be Considered (TBC)

   a. The IDEM Non-Rule Policy Document entitled "Contained-in Policy Guidance for RCRA" (NPD ID number WASTE-0052, 2002), which in turn references the federal guidance Management of Remediation Waste Under RCRA, EPA Publication Number 530-F-98-026, is a TBC. This nonrule policy document is intended solely as guidance and does not have the effect of a law or represent formal IDEM decisions or final actions. It is applicable to soil and groundwater which is generated and subsequently managed, and does not replace or alter requirements for closure or cleanups found in various regulatory authorities. This nonrule policy is available at http://www.in.gov/idem/rules/policies.

If you have questions concerning this correspondence, please feel free to contact me by email at kherron@ide.IN.gov or by phone at 317-234-0354.

Sincerely,

for

Kevin D. Herron, Project Manager
Federal Programs Section
Office of Land Quality
Indiana Department of Environmental Management

KDH:bl
Enclosure
cc: Rex Osborn

Mitchell E. Daniels, Jr., Governor
Robert E. Carter, Jr., Director

DNR Indiana Department of Natural Resources

Division of Historic Preservation & Archaeology•402 W. Washington Street, W274 · Indianapolis, IN 46204-2739
Phone 317-232-1646•Fax 317-232-0693 · dhpa@dnr.IN.gov

January 4, 2007

JAN 9 ~~2006~~ 2007

Kevin Herron
Indiana Department of Environmental Management
100 North Senate Avenue
Mail Code 50-01
Indianapolis, Indiana 46204

Agency: Indiana Department of Environmental Management ("IDEM")

Re: Information regarding applicable or relevant and appropriate requirements pertinent to the Jacobsville Neighborhood Soil Contamination Superfund Site (DNR #12494; DHPA #1325)

Dear Mr. Herron:

Pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. § 470f) and 36 C.F.R. Part 800, the staff of the Indiana State Historic Preservation Officer ("Indiana SHPO") has conducted an analysis of the materials dated November 29, 2006 and received on December 7, 2006 for the above indicated project in Evansville, Vanderburgh County, Indiana.

The Indiana SHPO is unable to determine by the information provided if any state funding will be involved for this project. If there will be an undertaking with the potential to effect historic resources, the following information will need to be submitted to our office for a review:

1) Detail any construction, demolition, and earthmoving activities.

2) Define the area of potential effects[1] and provide a map or a good quality photocopy of a map containing the following:

    - The boundaries of the area of potential effects and the precise location of the project area within those boundaries clearly outlined in dark ink on a copy of the relevant portion of a town, city, county, or U.S. Geological Survey quadrangle map.

    - The names of nearby landmarks clearly labeled (e.g., major streets, roads, highways, railroads, rivers, lakes).

3) Give the precise location of any buildings, structures, and objects *within the area of potential effects* (e.g., addresses and a site map with properties keyed to it).

4) Give the known or approximate date of construction for buildings, structures, objects, and districts *within the area of potential effects.*

5) Submit historical documentation for buildings, structures, objects, and districts *within the area of potential effects.*

6) List all sources checked for your historical research of the *area of potential effects*. The Indiana SHPO recommends consulting the 1993 Vanderburgh County Interim Report for this information.

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[1] Area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (see 36 C F R § 800 16[d])

7) Provide recent, clear photographs or good quality computer-generated images (not photocopies or aerial photographs), keyed to a site plan, showing the exterior of any buildings, structures, objects, or land *that could be affected in any way by the project.*

8) Describe the current and past land uses within the project area; in particular, state whether or not the ground is known to have been disturbed by construction, excavation, grading, or filling, and, if so, indicate the part or parts of the project area that have been disturbed and the nature of the disturbance; agricultural tilling generally does not have a serious enough impact on archaeological sites to constitute a disturbance of the ground for this purpose.

Once the indicated information is received, the Indiana SHPO will resume identification and evaluation procedures for this project. Please keep in mind that additional information may be requested in the future.

A copy of the revised 36 C.F.R. Part 800 that went into effect on August 5, 2004, may be found on the Internet at www.achp.gov for your reference. If you have questions, please contact Miriam Widenhofer of our office at (317) 232-1646.

In all future correspondence please refer to DHPA # 1325

Very truly yours,

Miriam L. Widenhofer

Miriam L. Widenhofer
Structures Review Assistant

MLW:mlw

cc: Christie Stanifer, Indiana Department of Natural Resources, Division of Water

City of Evansville
Environmental Protection Agency
Suite 100 – C.K. Newsome Community Center
100 East Walnut Street
Evansville, IN 47713
Phone (812) 435-6145 * Fax (812) 435-6155

Jonathan Weinzapfel, Mayor

January 23, 2007

U.S. Environmental Protection Agency – Region 5
Ms. Yolanda Bouchee, Community Involvement Coordinator
Ms. Jena Sleboda, Remedial Project Manager
77 W. Jackson Blvd.
Chicago, IL 60604

RE: Jacobsville Neighborhood Soil Contamination Site Clean Up

Dear Ms. Bouchee and Ms. Sleboda:

First, let me welcome you back to Evansville and express my gratitude for U.S. EPA's clean up of these contaminated properties! These yards and homes will be safer for our children because of this project and we sincerely appreciate your efforts!

For decades, to try to protect and improve our air quality, Evansville has enforced air quality ordinances more stringent than state or federal regulations, including rules intended to minimize dust from earthmoving activities. On January 8, 2007, the City adopted even more stringent rules. Because these new rules are very recent and because it is especially important to contain the lead / arsenic contaminated dust to prevent additional contamination, I wanted to make a special effort to provide you with this information so you could forward it to contractors interested in bidding on this project. The applicable portions of the Municipal Code are attached to this letter, but to summarize our requirements in plain English, contractors must:

- Keep the mud and dirt off streets and thoroughfares.
- Keep the dirt out of the air and prevent it from visibly crossing property lines.
- Cover the load on dump trucks or keep the load below the cab or cargo box.
- Prevent materials from leaking from the truck cargo area.

As major projects are announced for this region, Evansville Mayor Weinzapfel has made a special point of contacting the project planners and encouraging them to implement voluntary measures to conserve energy and reduce their impacts on the environment. For the Jacobsville project, we suggest that U.S. EPA include the following contractor requirements:

- Use dust suppressant measures as needed to minimize dust from earth-moving activities;
- Design and follow adequate Erosion Control Plans;
- Utilize Storm Water Best Management Practices;
- Require that all on and off-road equipment (bulldozers, backhoes, etc.) used in this project are equipped with particulate filters or Diesel Oxidation Catalysts (DOCs).
- Use a blend of 5% soy biodiesel and 95% Ultra-Low Sulfur Diesel for all diesel fueled equipment;
- Institute and enforce on-site "No-Idling" policies for all mobile equipment (semi-trucks, autos, construction equipment and delivery vehicles).

More than likely, U.S. EPA has already instituted these and additional measures for such projects and the suggestions provided above are already in place. Still, good ideas deserve repeating and we appreciate your consideration.

Again, thank you for your efforts and attention. Please contact the Evansville EPA if we can be of any assistance with this project.

Respectfully,

Dona J. Bergman
Director

Pc: Mayor Jonathan Weinzapfel
Ms. Rose Young, Chief of Staff
Evansville EPA Board

7) Provide recent, clear photographs or good quality computer-generated images (not photocopies or aerial photographs), keyed to a site plan, showing the exterior of any buildings, structures, objects, or land *that could be affected in any way by the project.*

8) Describe the current and past land uses within the project area; in particular, state whether or not the ground is known to have been disturbed by construction, excavation, grading, or filling, and, if so, indicate the part or parts of the project area that have been disturbed and the nature of the disturbance; agricultural tilling generally does not have a serious enough impact on archaeological sites to constitute a disturbance of the ground for this purpose.

Once the indicated information is received, the Indiana SHPO will resume identification and evaluation procedures for this project. Please keep in mind that additional information may be requested in the future.

A copy of the revised 36 C.F.R. Part 800 that went into effect on August 5, 2004, may be found on the Internet at www.achp.gov for your reference. If you have questions, please contact Miriam Widenhofer of our office at (317) 232-1646.

In all future correspondence please refer to DHPA # 1325

Very truly yours,

Miriam L. Widenhofer

Miriam L. Widenhofer
Structures Review Assistant

MLW:mlw

cc: Christie Stanifer, Indiana Department of Natural Resources, Division of Water

To view the Evansville Environmental Protection Agency's portion of the Municipal Code, go to "www.evansvillegov.org/epa" - on the left hand side of the home page, click on "Municipal Code of Evansville".

Section 3.30.212 Fugitive Particulate Matter.

(A) **APPLICABILTIY OF RULE:** This section shall apply to all sources of fugitive particulate matter.

(B) **DEFINITIONS:** Definitions of terms as set forth in this Section.

(1) "AS NEEDED BASIS." Means the frequency of application necessary to maintain compliance with the requirements of this Section.

(2) "CONSTRUCTION SITE ACCESS." Means a stabilized stone surface at all points of ingress or egress to a construction site for the purpose of capturing or detaining sediment carried by tires of vehicles or other equipment entering or exiting the project site.

(3) "FUGITIVE PARTICULATE MATTER." Means the generation of particulate matter to the extent that some portion of the material escapes beyond the property line or boundaries of the property, right-of-way, or easement on which the source is located or the activity causing the fugitive particulate matter emissions is taking place.

(4) "GROUND LEVEL." Means from zero (0) inches to thirty (30) feet above the ground.

(5) "MANUFACTURING PROCESS." Means any single or series of actions, operations, or treatments in which a mechanical, physical, or chemical transformation of materials occurs that emits or has the potential to emit, particulate in the production of the product. The term includes transference, conveyance, or repair of a product.

(6) "NOTICE OF INTENT LETTER." Means a written notification indicating a person's intention to comply with the terms of a specified general permit rule in lieu of applying for a specific NPDES permit and includes information as required in 327 IAC 15-3 and the general permit rule.

(7) "OVERSPRAY." Means the particulate matter resulting from surface coating activities not deposited on the part or surface for which it was intended.

(8) "PARTICULATE MATTER." Any finely divided solid or liquid material, excluding uncombined water.

(9) "PAVED PARKING LOT." Means any asphalt or concrete surfaced parcel of land located on the property of, or owned by, an individual or company upon which automobiles or other motorized vehicles are parked.

(10) "PAVED ROAD." Means any asphalt or concrete surfaced thoroughfare or right-of-way designed or used for vehicular traffic and located on the property of, or owned by, an individual or company.

(11) "UNPAVED PARKING LOT." Means any parcel of land located on the property of, or owned by, an individual or company lacking asphalt or concrete surfacing materials upon which automobiles or other motorized vehicles are parked.

(12) "UNPAVED ROADS." Means any surfaced thoroughfare or right-of-way, other than a paved road as defined above, which is designed or used for vehicular traffic located on the property of, or owned by an individual or company.

(13) "SURFACE COATING." Means the application of powder coating or a solvent or water-based coating to a surface that imparts protective, functional, or decorative films in which the application emits, or has the potential to emit, particulate matter. Surface coating does not include galvanizing.

(14) "USED OIL." Means:
   (a) Any oil that has been refined from crude oil that has been used and as a result of such use is contaminated by physical or chemical impurities; or
   (b) Any synthetic oil that has been used and as a result of such use is contaminated by physical or chemical impurities.
   (c) Any used oil will be presumed to be contaminated by physical or chemical impurities. It shall be the burden of the owner or operator to refute this presumption by providing acceptable scientific data to the Director.

(C) **EXEMPTIONS.** The following may be exempted from the requirements of this Section:
   (1) Release of steam not in combination with any other gaseous or particulate pollutants unless the steam creates a nuisance or hazard.
   (2) Fugitive particulate matter resulting from demolition where every reasonable precaution has been taken in minimizing fugitive particulate matter emissions.
   (3) Fugitive particulate matter caused by adverse meteorological conditions.
   (4) Fugitive particulate matter from parking areas and access drives on properties zoned R-1, R-2, or Agricultural so long as the actual usage of the property is in conformance with the zoning.

(D) **USED OIL.** Application of used oil.
No person shall apply or allow the application of used oil to any ground surface.

(E) **VIOLATIONS.**
   (1) The owner or operator of a source will be considered in violation of this section if evidence is obtained to verify the subject fugitive particulate matter originated from that source.
   (2) A source or sources generating fugitive particulate matter shall be in violation of this Section if:
      (a) A qualified representative of the Director observes fugitive particulate matter visibly crossing the site boundary or property line at ground level.
      (b) A qualified representative of the Director observes mud or soil tracked from the site boundaries onto a public street, thoroughfare, road, or public or private right-of-way.
      (c) A sworn law enforcement official observes fugitive particulate matter visibly crossing the site boundary or property line at ground level.
   (3) Photographs or video evidence may be utilized to determine a violation of this Section.

(F) **CONSTRUCTION OR DEMOLITION ACTIVITIES.** Fugitive particulate matter resulting from construction or demolition activities shall be controlled.

(1) Construction Activities disturbing over one (1) acre:

(a) For activities subject to 327 IAC 15-5, a stable construction site access shall be provided at all points of construction traffic ingress and egress to the project site.

(b) The Site Operator, as designated on the Notice of Intent letter issued pursuant to 327 IAC 15-5-2 (d) (1), shall be considered in violation of this Section if a qualified representative of the Director visually verifies mud or soil tracked from the construction site onto a public street, road, alley, highway, public or private right-of-way or other thoroughfare.

(i) In addition to the Site Operator, the Director may also determine other companies or individuals are in violation of this Section.

(ii) Failure to obtain a Notice of Intent letter or to provide a Notice of Intent letter upon request by the Director shall be a violation of this Section.

(G) **MOTOR VEHICLE SOURCES.** Fugitive particulate matter resulting from transportation or hauling of loose material such as, but not limited to, soil, sand, gravel, coal, grain, and other similar materials shall be controlled.

(1) No vehicle shall be driven or moved on any public street, road, alley, highway, or other thoroughfare, unless such vehicle is so constructed as to prevent its contents from dripping, sifting, leaking, or otherwise escaping therefrom so as to create result an emission of particulate matter.

(2) Soil, sand, gravel, coal, grain and other similar materials may be hauled in open trucks as long as the material is not allowed to fall on a public or private way and the requirements of 3.30.212 (G) (3) hereof are complied with.

(3) Vehicles hauling soil, sand, gravel, coal, grain and other similar materials on a public or private way without a cover shall be loaded in the following manner:

(a) The peak, or highest point, of the load shall not be higher than the top of the vehicle cab or cargo box, whichever is lower.

(b) All vehicles must have a leak proof gate. Pick-up trucks and other vehicles with a low-hinged tailgate must have a liner to prevent leakage.

(c) All areas of the vehicle not within the confines of the cargo box shall be free of loose materials.

(d) The vehicle cargo area, including but not limited to the bottom, tailgate hinges, latches and sideboards, must be in a substantial state of repair to prevent shifting or leakage of the cargo.

****

Section 3.30.251 Penalties

(A) In accordance with Section 3.30.201, unless specifically provided for in this Section, monetary penalties for violations of this Subchapter occurring within a thirty-six (36) month period shall not be less than those provided by the following.

(1) First Violation: $ 50.00

(a) The Director may issue a Letter of Violation without a monetary penalty for the first violation.

(b) If the Director issues only a Letter of Violation, if a second violation is determined within a thirty-six (36) month period from the date of the first violation, the minimum monetary penalty shall begin at fifty dollars ($50.00) for the second violation.

(2) Second Violation: $ 150.00
(3) Third Violation: $ 500.00
(4) *Fourth Violation: $1,500.00*
(5) Fifth and subsequent Violations: $1,500.00 to $7,500.00.

(B) Violations prior to the effective date of this ordinance shall be included in the calculation of the number of offenses. The maximum monetary penalty shall be $7,500.00 per day, per violation.

(C) After the Director has determined that four (4) or more violations of this Subchapter have occurred at the same location or by the same person or company within a six-month period, the Director may, subject to appeal to the Environmental Protection Agency Board, upon determining a fifth violation, stop work on the project or at the facility and cause the immediate cessation of work on all or part of the project or at the facility until the conditions causing the violation(s) have been corrected.

(D) The Director, subject to appeal to the Environmental Protection Agency Board, may suspend, cancel or refuse to issue or renew any applicable permit provided in this Subchapter (3.30.195--3.30.251) relating to the violation committed.

(E) If the Director's action pursuant to subsections (C) and/or (D) are appealed, the Board shall fix a place and time not less than forty-eight (48) hours or more than seventy-two (*72)* hours (excluding Saturdays, Sundays and legal holidays) thereafter for a hearing to be held before the Board. Not more than twenty-four (24) hours after the commencement of such a hearing, the Board shall affirm, modify or set aside the order of the Director.

APPENDIX E
Detailed Cost Analysis of Remedy

Alternative 2--Soil Excavation, Backfill, and Site Restoration for 39% of Properties within OU2

Jacobsville Neighborhood Soil Contamination Revised Final FS Report Cost Estimate

Description: Excavation of soils within residential parcels, transportation and disposal, and site restoration which includes backfill, topsoil, and seeding.

CALCULATIONS

Excavation Volumes and Quantities

1. Residential Lot Excavation Area

Lot size excludes footprint of building

Area of Average Lot (GIS)	3,652	ft^2
	0.08	acres
Total Number of Parcels	10,440	

2. Residential Excavation per Parcel

Volume per parcel	3,652	ft^3
	135	yd^3
Disposal (correction factor 1.6)	216	tons

3. Residential Excavation Totals

Total Number of Parcels (39%)	4,072	parcels
Total Volume of Excavations	550,722	yd^3

4. Site Restoration

Volume of general fill per parcel	68	yd^3
Total volume of general fill	275,361	yd^3
Volume of topsoil (loose) per parcel	68	yd^3
Total volume of topsoil (loose)	275,361	yd^3

ASSUMPTIONS

1. Property Assumptions

Average parcel size is 4658 ft^2 based on 2007 Vanderburgh County Assessor's Office. Impervious surfaces assumed to cover 1006 ft^2 based on 35% of OU2 residential properties recorded by Vanderburgh County Assessor's Office. Average area requiring excavation per lot is 3652 ft^2.

2. Quantity Assumptions

Approximately 200 to 300 properties remediated per year based on Engineer's Estimate and assumes a construction season of April through November.

39% of Properties will be remediated over 16 year period.

3. Sampling Requirements

Estimate assumes that confirmation sampling will not required after excavation.

Sampling frequency for clean backfill, 1 TCLP sample per 1,000 yd^3

4. Excavation and Disposal

Soil excavation may require hand excavation and double handling of material. material. Assume up to 2 trees per lot will be removed (avg 12-18 in diameter). Soil at properties will be excavated to 12 in.

5. Site Restoration

Backfill includes 6 in of clean fill and a 6 in of top soil.

Seeding will be representative of local native grasses.

Trees and shrubs will be replaced in lots only where they previously existed. Inventory taken before cleaning and grubbing.

Single Property Excavation Cost - 12" Depth

Description	Qty	Unit	Unit Cost	Total Cost	Notes
Property Requirements					
Access Agreement	4	hr	$ 108.00	$ 432	Engineers Estimate
Pre-construction Property Assessment/Photograph	3	hr	$ 108.00	$ 324	Engineers Estimate
Post Construction Assessment	2	hr	$ 108.00	$ 216	Engineers Estimate
Fence Removal/Replacement	25	LF	$ 20.00	$ 500	Engineers Estimate
Gate Removal/Replacement	1	each	$ 350.00	$ 350	Engineers Estimate
Utility Repair Allowance	1	LS	$ 500.00	$ 500	Engineers Estimate
Concrete/Asphalt Repair Allowance	100	SF	$ 8.00	$ 800	Engineers Estimate
Air Monitoring					
Air Monitoring	2	each	$ 145.00	$ 290	Engineers Estimate
Excavation and Disposal					
Clearing/Grubbing	0.08	AC	$ 12,900	$ 1,082	Engineers Estimate
Tree/Stump Removal & Disposal	2	each	$ 500	$ 1,000	Engineers Estimate
Shrub/Stump Removal & Disposal	6	each	$ 30	$ 180	Engineers Estimate
Vegetation Debris Box	1	each	$ 83	$ 83	Engineers Estimate
Vegetation T&D	6	tons	$ 50	$ 300	Engineers Estimate
Soil Excavation	135	yd^3	$ 32	$ 4,328	Engineers Estimate
Laboratory Analysis (including labor)	1	LS	$ 614	$ 614	Engineers Estimate
Soil Waste T&D (correction factor 1.6)	216	ton	$ 38.05	$ 8,235	Allied Waste Laubscher Meadows Landfill
Water Control (baker tank, analysis, treatment)	8	gal	$ 15	$ 120	Engineers Estimate
Restoration					
Demarcation Fencing	125	SF	$ 0.14	$ 18	McMasters
General Fill (Compacted) & Analysis per 1,000 yd^3	68	yd^3	$ 31	$ 2,097	Evansville Materials and Floyd Staub
Top Soil (Loose)	68	yd^3	$ 44	$ 2,976	Floyd Staub
Seeding/Fertilizer/Erosion Control Blanket	3,652	ft^2	$ 0.40	$ 1,461	Engineers Estimate/Garden Alive
Vegetation Maintenance (5 months)	1	LS	$ 1,725	$ 1,725	Engineers Estimate
Tree Restoration	2	each	$ 250	$ 500	Commercial Landscaping/Integrity
Shrub Restoration	6	each	$ 45	$ 270	Commercial Landscaping/Integrity
Street Cleaning	1	LS	$ 500	$ 500	Engineers Estimate
Survey Support					
Pre/Post Residential Lot Survey	2	LS	$ 1,150	$ 2,300	Engineers Estimate
Staging Area					
Staging Area (lease, erosion control, utilities)	1	LS	$ 105	$ 105	Engineers Estimate
Security	1	LS	$ 66	$ 66	The IRA E. Clark Agency, Inc.
Community Relations					
Public Meeting	2	each	$ 12	$ 25	Engineers Estimate
Subtotal					$31,395
Remedial Design				6%	$1,884
Contingency				20%	$6,279
Subtotal of Single Property Excavation Cost - 12" Depth					$39,557

Item	Quantity	Unit	Unit Cost	Cost	Notes	Total
Property Excavation Cost (on a Per Year Basis)						
Number of Properties Excavated per Year	261	each	$39,557	$10,324,401	Engineers Estimate	
Total Property Excavation Cost per Year						$10,324,401
Additional Costs of Alternative 2 (on a per year basis)						
Parcels Not Requiring Excavation						
Access Agreement	398	each	$ 432	$ 171,947	Engineers Estimate	
Subtotal						**$171,947**
Total Cost of Properties with Additional Costs						**$10,496,348**
Associated Planning and Construction Costs						
Mobilization/Demobilization				10%		$1,049,635
Construction Oversight/Project Management				15%		$1,574,452
Reporting				10%		$1,049,635
Subtotal						**$3,673,722**
Total Cost with Additional Costs & Planning and Construction Costs (on a Per Year Basis)						**$14,170,069**

Present Value Analysis			
Present Worth of Property Excavation	*7.0%*	*Discount Rate*	
Year 2	0.8734	$	12,376,687
Year 3	0.8163	$	11,566,997
Year 4	0.7629	$	10,810,278
Year 5	0.7130	$	10,103,064
Year 6	0.6663	$	9,442,115
Year 7	0.6227	$	8,824,407
Year 8	0.5820	$	8,247,109
Year 9	0.5439	$	7,707,579
Year 10	0.5083	$	7,203,345
Year 11	0.4751	$	6,732,098
Year 12	0.4440	$	6,291,680
Year 13	0.4150	$	5,880,075
Year 14	0.3878	$	5,495,397
Year 15	0.3624	$	5,135,885
Year 16	0.3387	$	4,799,893

Item	Quantity	Unit	Unit Cost	Cost	Notes	Total
Operation and Maintenance Costs						
Five Year Review	1	LS	$ 49,000	$ 49,000	Engineers Estimate	
Cost of O&M (5-year review)					$	**49,000**

Present Value Analysis			
Present Worth of O&M (5-year review)	*7.0%*	*Discount Rate*	
Year 5	0.7130	$	34,936
Year 10	0.5083	$	24,909
Year 15	0.3624	$	17,760
Year 20	0.2584	$	12,663
Year 25	0.1842	$	9,028
Year 30	0.1314	$	6,437
Year 35	0.0937	$	4,589
Year 40	0.0668	$	3,272
Year 45	0.0476	$	2,333
Year 50	0.0339	$	1,663
PRESENT WORTH (2008) CAPITAL COSTS for 39% of PROPERTIES IN OU2		**$**	**134,904,270**

Notes:

1) The estimate above is considered budgetary-level cost estimating, suitable for use in project evaluation and planning. This estimate has been prepared without design or engineering calculations. Actual construction costs are expected to vary from these estimates due to market conditions, actual costs of purchased materials, quantity variations, regulatory requirements, and other factors existing at the time of construction. Expected level of accuracy is +50% / -30%.

2) Costs were based on Commercial Landscaping (IN), Integrity (IN), Garden Alva, McMasters, Allied Waste Laubscher Meadows Landfill (IN), Evansville Materials (IN), Floyd Staub (IN), The IRA E. Clark Agency, Inc (IN), and Engineer's Estimates. Costs are based on present worth. Escalation assumptions were not included in costs.

3) *Mobilization/Demobilization* costs will include site setup, facilities, utility location, erosion and sediment controls, signage, decontamination cell, residential access during construction, dust suppression, site teardown/restoration, and demobilization.

4) *Construction Oversight/Project Management* costs include daily oversight, health and safety requirements, project management requirements, subcontractor procurements, and any day to day requirements deemed necessary.

5) Health and Safety and Environmental Plans include but not limited to quality control, health and safety, transportation, storm water pollution prevention, and construction quality plan.

6) *Community Relations* costs include equipment for meeting, labor, and travel expenses.

7) *Reporting* costs include development of the work plan and other required planning documents including but not limited to quality control, health and safety, environmental protection, and completion reporting (as built drawings).